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SPECIFICATION

OF

LOUIS NAPOLEON LEGRAS.

SEPARATION AND DISINFECTION OF FECAL  
MATTERS IN THE MANUFACTURE OF  
MANURE, &c.

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**Separation and Disinfection of Fecal Matters in the  
Manufacture of Manure, &c.**

**LEGRAS' SPECIFICATION.**

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, LOUIS  
NAPOLEON LEGRAS, formerly of Paris, in the Republic of France, but now  
residing at No. 2, Tenison Street, in the Borough of Lambeth, in the County  
of Surrey, Civil Engineer, send greeting.

5 WHEREAS Her present most Excellent Majesty Queen Victoria, by Her  
Royal Letters Patent under the Great Seal of the United Kingdom of Great  
Britain and Ireland, bearing date at Westminster, the Thirtieth day of  
November, One thousand eight hundred and forty-nine, in the thirteenth  
year of Her reign, did, for Herself, Her heirs and successors, give and  
10 grant unto me, the said Louis Napoleon Legras, my exors, admors, and  
assigns, Her especial licence, full power, sole privilege and authority, that I,  
the said Louis Napoleon Legras, my exors, admors, and assigns, and such  
others as I, the said Louis Napoleon Legras, my exors, admors, or assigns,  
should at any time agree with, and no others, from time to time and at all  
15 times during the term of years therein expressed, should and lawfully  
might make, use, exercise, and vend, within England, Wales, and the Town  
of Berwick-upon-Tweed, my Invention of "IMPROVEMENTS IN THE SEPARATION  
AND DISINFECTION OF FECAL MATTERS IN THE MANUFACTURE OF MANURE, AND IN  
THE APPARATUS EMPLOYED THEREIN;" in which said Letters Patent is con-  
20 tained a proviso that I, the said Louis Napoleon Legras, should cause a  
particular description of the nature of my said Invention, and in what manner  
the same is to be performed, by an instrument in writing under my hand and  
seal, to be inrolled in Her said Majesty's High Court of Chancery within six  
calendar months next and immediately after the date of the said in part  
25 recited Letters Patent, as in and by the same, reference being thereunto had,  
will more fully and at large appear.



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NOW KNOW YE, that in compliance with the said proviso, I, the said Louis Napoleon Legras, do hereby declare the nature of my said Invention, and in what manner the same is to be performed, are fully described and ascertained in and by the present Specification thereof, reference being had to the Drawings hereunto annexed, that is to say :— 5

Firstly, my Invention has for its object the construction of waterclosets, and of apparatus connected therewith, in such manner as to separate and keep apart, in different vessels, the solid portions of fecal matters from whatever liquids may be combined therewith.

Figure 1 represents an exterior elevation and Figure 2 a sectional elevation 10 of a watercloset and appendages, constructed according to my said Invention. C is an oval-shaped vessel, which gradually decreases in diameter towards the top, and has the upper and lower edges turned over to form flanges O, O, as shewn in the Drawings. E is the separator, which is fitted with a flange near the top, and rests thereby upon the upper flange O of the vessel C, within 15 which it is thus suspended; A is the neck, which is furnished with a flange at bottom and placed on the top of the vessel C. The neck A, the vessel C, and separator E are then riveted or bolted together; G is an oscillating plate, which is supported by a spindle s in suitable bearings, and H, H, are conduits, which are made with couplings in order that they may be united when required. 20 The neck A and vessel C are fitted with two guides U, U, in which slides the rod B. This rod has a piece V projecting at right angles from it, which carries the catch suspended perpendicularly above the detent T. When the rod B is moved down the catch X slides either on the left or right hand of the detent T according to the inclination given to it, and catches the under part of the 25 detent T by the barbed point. The opening a of the neck A is placed immediately under the watercloset, and the liquids which accompany the fecal matters, and which have an inclination to follow the direction of the sides of the vessel, run down the sides of the neck A, and fall between the vessel C and the separator E on to the flange of the latter, whence they pass through 30 the conduits H, H, while the solid portions fall by their weight into the separator E (as well also as that part of the liquid which did not run down the sides), and will be received on the oscillating plate G, which closes the opening of the separator in an inclined direction. By this arrangement the solids will always fall in the angle of the separator E, and the liquids which 35 run down the sliding plate G will escape through the perforations F in the separator E, into the lower part of the vessel C, whence they will pass through the opening L to some suitable receptacle, while the solids will remain in the corner until the position of the oscillating plate is reversed, when they will



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be precipitated into the centre of the mouth D, and will escape by the opening L<sup>1</sup> into some suitable receptacle provided for that purpose. The reversal of the oscillating plate is effected in the following manner:—On opening the door of the watercloset the rod B, with the projection V, which carries the  
 5 catch X, will be drawn up. The catch X, having previously gripped the detent T, will, when lifted up, cause it to turn, and, in consequence of its being centred on the spindle s of the oscillating plate G, the latter will be caused to turn also, and thereby to reverse its position. The oscillating plate is kept in position by means of springs, until its position is again changed by a repetition  
 10 of the same operation. The shutting of the door will have the effect of causing the rod B to descend, and thereby bring the catch X under the detent T ready for the next occasion.

Figure 3 represents another arrangement and construction of apparatus for effecting the separation of the solid and liquid portions of fecal matters. The  
 15 vessel A terminates in a double bottom E and E<sup>1</sup>. The matters, both liquid and solid, are received on the bottom E. It will often occur that the liquids which have a marked inclination to run down the sides of the vessel will run down the sides  $\alpha$ ,  $\alpha$ , and pass under the first bottom E and run into the gutter X, which will conduct them to the outflow pipe G; the solid matters, having  
 20 by the effect of gravity a tendency to fall in a direct line, drop on to the first bottom E in the interior of the frame B. J is a counterbalance weight which is moved by a mechanical arrangement similar to that before described or by hand. H is one of two hinges on which turns the curved plate C. To about the centre of this plate there is hinged a moveable frame B (without a  
 25 bottom) in order that it may receive through its centre the solid matters, and that in moving the handle J the curved plate C shall be swung out, carrying with it the frame B, which will scrape the solid deposits from the bottom E into the outflow pipe F, which conducts them into a suitable receptacle provided for the purpose. The working of the frame, counterbalance weight,  
 30 and curved plate C is effected by a sudden retrograde motion produced by a mechanical arrangement similar to the one before described. Although the special object of the curved plate C is to draw back the frame B it also serves to guide the fall of the solid matters into the frame B, and the liquids which spread over its surface into the gutter, whence they escape, as has been before  
 35 explained.

Figure 4 (a sectional elevation) and Figure 5 (a top plan) of the Drawings annexed represent a modification of the apparatus, firstly herein-before described, for separating the solid from the liquid portions of fecal substances, combined with an arrangement of apparatus for applying to the solids some disinfecting



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substance or compound. A is the upper part, and B the body of the apparatus. J is a sliding curved plate, which moves in a recess K, having on each side a groove to guide the plate J in its movement. C is a half cylinder, soldered in front of the holes L, which are bored in the part B next above the level of the sliding plate J. The liquid runs off the sliding plate, through these holes L, 5 into the half cylinder C, which conducts them through a pipe D into a receptacle. The plate J, which is inclined, in order that the liquid may run off rapidly from the solids, is moved to and fro, so as alternately to open and close the outfall pipe B<sup>2</sup>, by the following arrangement:—The upper end of the sliding plate J is fitted with a cross piece O, O, at each end of which there is 10 attached a cord or chain passing over a pulley indicated by dotted lines in the Drawing. H is a counterbalance weight attached to the other end of the chain, which serves to draw in the sliding plate J, and thereby close the opening. E is a wrought iron bracket attached to the body B of the apparatus, which carries at the other end a pulley Z, furnished with a cord or chain O<sup>2</sup>. 15 The other end of the chain is connected to the rod O, so that by turning the pulley Z the sliding plate will be drawn out and the outfall B<sup>2</sup> opened. The pulley Z is made to revolve by means of a ratchet Z<sup>1</sup>, which turns loosely on the spindle of the pulley, but is fixed by a pawl attached to the latter when it revolves with it. Y is a pinion centred on the ratchet spindle, and moved by 20 the action of a rack or pitch chain Y<sup>2</sup>. When the chain Y<sup>2</sup> is drawn up the pinion Y will revolve, as will also the pulley Z, which will wind up the chain O<sup>2</sup>, and thereby draw out the sliding plate J, and open the outfall B<sup>2</sup>. When the rack or pitch chain ceases to act, and the wheels are free to turn, the counterbalance weight H will come into action, and draw in the sliding plate, so as to 25 close the outfall B<sup>2</sup>. To raise the rack or pitch chain, it is connected to the door of the watercloset or to a moveable seat, to a cover or to a moveable plank. And the movement of any of these appendages to the extent of about four inches is sufficient to open and shut the outfall by means of the to-and-fro motion of the sliding plate. By this arrangement of apparatus the solid 30 and liquid substances will fall together out to the sliding plate J, and the liquids will flow through the holes L into the half cylinder C, whence they will pass through the pipe D into their receptacle, while the solid matters will be scraped into their receptacle when the sliding plate is drawn back. As the chain is unrolled, and the pulley Z turns in the reverse direction, the catch U attached 35 to the latter will strike against the catch U<sup>1</sup> attached to the powder box N, and cause it to make a partial revolution. The powder box is made by preference in the form of a triangle (as seen at N, because it will discharge its contents with greater facility than when made of any other form), with an opening in



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each angle, and may be placed either above the receiver or in the watercloset. It may, however, be made in the shape of a cylinder, and supported by spindles in the upper part of a hopper of zinc P, which conducts the disinfecting powder discharged in sufficient quantity at each movement on to the solids. The  
 5 quantity of powder discharged is regulated by means of a slide.

Figure 6 represents a sectional elevation of another construction and arrangement of apparatus for separating and disinfecting fecal substances. Y is the seat (of the watercloset on the ground floor); it is attached to the projecting portion of the main drain pipe, which terminates in the form of a hemisphere C.  
 10 E is a pipe which opens at bottom into the vessel A destined for the reception of the solids, and at top into the centre of the main drain, as indicated in the Drawings. The solid portions coming from the upper stories of the house or the seat Y on the ground floor, follow the inclined sides D of the main drain until they arrive at the point e, from which they are directly  
 15 projected into the centre of the pipe E, while the liquids continue to follow the curved surfaces of the sides, and run down into the hemispherical bottom C, whence they escape by the pipe O into the receiver M. To effect the permanent disinfection of the solids, a vessel V, containing the disinfecting compound, is fixed in the watercloset on the ground floor. This vessel terminates in a  
 20 cylinder U, which contains a bucket wheel T. The spindle of the bucket wheel passes through the sides of the cylinder, and carries at one end a pitch wheel S, over which a pitch chain S<sup>2</sup> is passed. O<sup>2</sup> is a pipe which opens at top into the cylinder underneath one of the buckets, and at bottom into the main drain, as shewn in the Drawings. The partial revolution of the pitch  
 25 wheel will carry the division of the wheel which contains a portion of the disinfecting powder with which it was supplied from the vessel V (when underneath its lower opening) round over the pipe O<sup>2</sup>, whereby its contents will be discharged through the latter. The bucket wheel is made to revolve by means of the pitch chain S<sup>2</sup> (passing over the pitch wheel S), which is attached at one  
 30 end to the door R of the watercloset, and to a weight M<sup>2</sup> at the other. When the door is opened from the outside the descent of the weight M<sup>2</sup> will draw the chain down and cause the bucket wheel T to revolve and discharge a certain determinate quantity of powder. When the door is closed the chain will slide back over the pitch wheel, which will be prevented from revolving in the  
 35 reverse direction by means of a spring catch. When the door is opened from the inside the bucket will again revolve and discharge a fresh supply of powder on to the solid, in order that the soil from the upper stories may be received thereon.

Figure 7 represents a modification of the preceding arrangement, in which the powder reservoir V, before described, is replaced by the one indicated by



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the letter A, which discharges the necessary quantity of powder by means of a valve D (worked by the same mechanical arrangements as in the preceding case) through the pipe G into the main drain. The construction of the main drain differs from the one before described, inasmuch as it is made in two parts. The upper part has its outfall contracted and opens into the lower one, 5 which is made exactly the same as the lower part of the main drain, shewn in Figure 6. The outfall of the upper part is fitted with a valve V, which closes it when not in use by the action of the counterbalance weight Z. A charge of disinfecting powder is dropped on to the surface, which, when it has received a sufficient weight of fecal matters to overcome the resistance of the counter- 10 balance weight Z, opens and precipitates the solids through the pipes A<sup>1</sup>, A<sup>1</sup>, into the receptacle A<sup>2</sup>, while the liquids first pass through the holes in the valve into the pipe Z<sup>2</sup>, and thence through the pipe Z<sup>3</sup> into the hemispherical bottom, from which they escape into the receptacle M. The powder reservoir in this instance consists of a case A, which contains a vertical rod B, having attached 15 to it eight cross pieces of the form represented in the Drawings. C, C, are two guides, in which the rod B moves up and down to the extent of about four inches. The rod rests at bottom on the valve D, which is made to open and close the powder case by means of the spring catch E, acted on by a coiled spring E<sup>1</sup>, which is brought into play by the movement of the door R. When 20 the door is opened it draws back the chain S, and distends the spring E<sup>1</sup>, made fast at one end to a standard, and at the other to the catch which opens the valve D. The rod will then descend and discharge the powder through the pipe G into the main drain A<sup>1</sup>. On shutting the door the chain S descends, which allows the spring E<sup>1</sup> to collapse and close the valve D, whereby the 25 rod will be pushed up, and will, by means of the cross pieces, shake the powder down on to the valve and prevent it from clogging in the case.

Figure 8 of the Drawings is a sectional elevation of another of my improved waterclosets, which in its general arrangement and construction resembles the one just described, but is provided with two receiving vessels B, B, which 30 are fitted with two valves, worked by means of a step and a system of levers in combination with other mechanical arrangements. J is the step which is connected to the lever U by the two rods Z, Z. The lever U is connected by rods K, K, to the lever L, L, which is connected by rods Z<sup>2</sup>, Z<sup>2</sup>, to the valve H. The other end of the lever L, L, is fitted with a cross piece L<sup>2</sup>, which has 35 attached to it a counterbalance weight M, and is connected by rods N<sup>2</sup> to the valve G. When the lever U is depressed by stepping on the step J the valve G will be opened and the valve H closed, but when the pressure is removed, the counterbalance weight M will, through the intervention of the levers and



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connecting rods before specified, close the valve G, and open the valve H, whereby the gases and odour from the fecal matters will be prevented from entering into the apartment. The descent of the step J, by raising the weighted end of the lever L, L, will lift up the curved rod R, and cause its  
 5 extremity to strike against one of the teeth of the ratchet O, which is keyed on the axle of the distributing bucket A, placed under the powder reservoir V, and carry it round one fourth of a revolution, whereby a determinate quantity of disinfecting powder will be discharged through the pipe X into the vessel B. The distributing bucket A is enclosed with an exterior casing P.

10 Figure 9 is an exterior elevation of a double acting, lifting, and forcing pump, having two or more barrels for emptying the liquids which have been separated from the solid fecal matters. A, A', are two leathern pipes. The pipe A is fitted at one end with a rose W, and placed inside near the bottom of the liquid reservoir, and communicates at top with the barrels of the pumps  
 15 by smaller branch pipes as shewn in the Drawings. The other pipe A' communicates in like manner with the barrels at bottom, and at top with the liquid cart N. H, H, are two handles (for communicating power) attached to the ends of two shafts, on which are keyed pinions B, B, which gear into toothed wheels C, C, keyed on the main crank shaft D. E, E, E, E, are two  
 20 sets of connecting rods which are attached at top to the cranks of the main shaft, placed on either side of each pump barrel, and at bottom to the lower ends of the side rods F, F, F, F. These last are attached to the cross heads H<sup>1</sup>, H<sup>1</sup>, of the plungers, so that by turning the handles the pumps will exhaust the liquid from the reservoir and force it into the cart.

25 Figure 10 represents another of my improved waterclosets, in which the main drain X descends into the curved vessel O, to about two thirds of its depth, and terminates in a lip-shaped tube V. The vessel O is fixed to and encircles the upper part of the vessel T so as to form a kind of gutter, which communicates by means of a pipe y with the lower part Z of the vessel T.  
 30 The liquids which flow from the upper stories will be guided by the lip-shaped discharge tube V into the gutter aforesaid, and will escape through the tube Y into the bottom Z of the vessel T, whence they will pass by the pipe Z<sup>1</sup> into the reservoir M, while the solids will be precipitated through the opening W of the vessel T into their separate receiver P, as in the preceding cases. The  
 35 outfall of the pan R of the watercloset on the ground floor is also made to open into the lip-shaped discharge pipe V, exactly opposite the outflow end of the main drain, and the discharge pipe V is placed over the opening W of the vessel T, in order that the solids may be precipitated through it into the receiver P. The liquids coming from the ground floor, and thus separated,



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will flow through the same channels as the others into the reservoir M. In this construction of watercloset I propose to employ the disinfecting agent in a liquid instead of powdered state.  $A^2$  is the vessel in which the liquid is contained, and may be of any convenient form. At bottom this vessel opens into a smaller one  $A^3$  of the construction shewn. C is a double conical valve 5 which is opened by closing the door, the spindle of which is attached to a chain S passing over a pulley and made fast to the door; the upper valve is closed by shutting the door (when the lower valve is opened), and opened when the door is opened (and the lower valve closed); so that only a certain determinate quantity of liquid will be able to escape at each operation down the pipe 10 N into the reservoir of solids.

Figure 11 represents another of my improved waterclosets, which is of simpler and cheaper construction than those before described. A is the neck piece, which is made in the shape of a funnel reversed, with the upper part slightly enlarged; it is fitted at bottom with an interior rim or flange Z, whereby it 15 rests upon another rim or flange attached to the exterior of the vessel B, which rises inside to about half the height of the vessel A, and is of somewhat smaller diameter, so as to leave a space between the two for the passage of liquids, as is herein-after explained, and to form with the flange Z a gutter. The two flanges are bolted or riveted together, and coated with mastic, to prevent 20 leakage. The lower and contracted part of the vessel B is made with a flange Y, which is bolted to another flange on the upper part of the vessel C, which is also in the shape of a funnel with the upper end enlarged, and is flanged at bottom on the inside, whereby it is bolted to a flange on the piece D, the lower edge of which is turned up inside so as to form a kind of circular gutter, 25 and projects upwards into the vessel C to about one third its height. To the curved part of the piece D there is attached a gutter piece E by means of flanges and bolts, which has its lower ends turned up inside to project upwards into the opening of D, much in the same manner as in the preceding case. X is a pipe fixed to an opening in the gutter piece E, which serves to conduct 30 the solid matters into their reservoir Y. J is the opening in the gutter Z of the neck piece A to which the pipe H is attached which conducts the liquids through the opening  $J^1$ , into the main pipe K, and thence to their reservoir. The liquids which have been received into the gutters D, E, will flow through the opening L into the main pipe K. F is a pear-shaped piece which is 35 affixed to (but may be detached therefrom at pleasure) the upper part of the neck A, as shewn. To the large end of the piece F there is attached by the base a small conical piece, the apex of which takes into without touching the sides of the lipped opening of the pipe G, which opens into the pipe H. The



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solids which fall on the pear-shaped piece F will slide off by the effect of their gravity, and fall through the vessels B, C, and X, into the reservoir Y, while the liquids will run down the sides of the pear-shaped piece F on to the cone, and be discharged at its apex into the opening, and through the pipes G, H, 5 and K, into the liquid reservoir.

Figure 12, a sectional elevation, and Figure 13, an exterior elevation, represent another of my improved waterclosets. A is the main drain pipe from the upper stories; B is the separator which opens into the lower part of the pipe A, and encircles the pipe C just below the top, so as to form a gutter. A portion 10 of the liquids will fall into this gutter, and will be conveyed thence by the pipe G and F into the liquid reservoir M. The pipe C passes through the floor into the cellar, and, being curved as shewn, opens into the vessel D, which receives the solids and the rest of the liquids, and serves as a cover to the cylinder E. The cylinder contains two bottomless vases or boxes H, I, of the forms shewn 15 in the Drawing. The vase H is supported on the top of the vase I in such manner that there shall be a space of about half an inch all round between the sides of the two vases, in order that the liquids which run down the interior sides of the vase H may fall through this space into the gutter *j, j*, in the bottom of the cylinder E, and pass thence through the pipes K and F into the 20 reservoir M. The lower ends of the vase I are turned up at right angles, and encircle and come into contact with the neck of the solids's reservoir L. The sides of the vase I are perforated with holes near the flange, in order that the liquids which may have accompanied the solids in their descent into the vase I, and run down its sides, may escape through these perforations into the gutter *j, j*, 25 and through the pipes into the reservoir M. N is the seat of the watercloset, which is made to discharge the disinfecting agent from the reservoir O in determinate quantities by any of the mechanical arrangements before described.

Figure 14 is a sectional elevation of another of my improved waterclosets. A is a basin open at bottom, which is placed within another basin K, and 30 supported by a flange at top, resting on the edge of the latter without the sides coming in contact, in order that there may be a space left between them all round. The lower part of the basin K is closed by a valve B at bottom, and is perforated with six rows of holes round the lower part of the sides, whereby the liquids which fall with the solid matters into the basin A will rise under its 35 edges into the space between the two basins, and escape through the perforations in the basin K into a third basin L, and thence by the opening M into the pipe E, which conveys it to the liquid reservoir. The solids which were deposited on the surface of the valve B, and have been separated from the liquids by the escape of the latter through the perforations in the basin K, are



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discharged into the vessel D, and fall through the opening F into their receiver by causing the valve B to open. This is effected by pushing down or pulling up the handle Z of the rod C, which is connected to one end of a shaft I, to which there is pivoted an oscillating lever H connected to the valve B. When the handle is released the counterbalance weight G comes into play, and 5 depresses the end of the lever H, thereby raising the valve B and closing the opening of the basin K. The valve B is hollow and is fitted with a pipe which passes through a slot into the pipe E, and the face of the valve B is perforated to allow of the escape of whatever portion of liquid may not have passed through the holes in the basin K to the liquid reservoir. This apparatus 10 consists of two parts bolted or riveted together at the line X, and is provided with any of the arrangements before described for discharging disinfecting agents in the form of a liquid or powder on to the surface of the solid fecal matters.

Figure 15 is a sectional elevation of a modification of the construction and arrangement of watercloset last described, and differs only in the external 15 configuration, which is round instead of rectangular, and in the mode of working the valve. The step Z is substituted for the handle in the former case, and is attached to one end of a lever C, centred on the pin W, which is connected at the other end to the rod C', attached to the shaft I and valve spindle H. By depressing the step Z the rod C' and the end of the valve 20 spindle H near to it will be elevated, and the valve B be thereby thrown open. The same movement also works the powder box by means of the chain z<sup>2</sup>.

Figure 16 (a sectional elevation), and Figure 17 (a top plan), represent a portable watercloset, constructed according to my Invention, for the separation of liquids from the solids of fecal substances. E is the step. D the side 25 opening, through which the liquids' and solids' receivers are introduced and withdrawn when required. H is the pan, made of china or glazed earthenware. I, the opening in the bottom of the pan. B is the cover, to which there is attached a vessel or box K for containing the disinfecting agent. A is an opening in the cover B for introducing the disinfecting agent into the vessel K, 30 which may be stopped up when required. L is a pipe which opens at top into the vessel K, and at bottom into the pan as shewn in the Drawing, whereby, on lifting the cover B, a portion of the disinfecting agent will be discharged through it into the pan H. J is a pulley, round which passes a chain Q attached at top to the cover B and at the other end to the sliding piece N, 35 which will be drawn over and close the opening I of the pan when the cover B is lifted up. The solids and liquids are received upon the sliding piece N. The former remain and the latter run off down the outsides of the vessel R into the gutter S, whence they pass into the appropriate reservoir X when the chain



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is released by closing the cover B. The reaction of the spring V, one end of which is fixed to the bracket W, will push back the sliding piece N and bring the cut way portion of it M underneath the opening of the pan H, whereby the solids will be scraped from the sliding piece into the vessel R, and will fall  
5 through the mouth T into their appropriate receiver Y. Whatever liquids may have fallen into R with the solids will run down its inside into the gutter S, and thence into X. A chain and counterbalance weight may be substituted for the spring V. The movement of the different parts may be effected by means of the step E, or a moveable seat, instead of by the cover B.

10 Figure 18 is a sectional elevation through the centre of the shaft O, and Figure 19 is a sectional elevation along the centre of the shaft O of another of my improved waterclosets, shewing only the apparatus for separating the liquids from the solids of fecal substances. The exterior casing is in two pieces, A, A, and B, B, which are made of the form shewn in the Drawings  
15 with flanges at the two sides X, X, and bolted together at the centre; *a*, is the neck piece, which is adapted to the outfall of the pan or drain; *b*, *b*, is an interior casing, which opens under the neck *a* and encircles the upper part of the lipped pipe *d*, *d*. The casing *b*, *b*, is made fast at bottom to a flange fixed on the inside of the upper part A, A, of the exterior casing and forms  
20 therewith a gutter *c*, *c*, which communicates by means of the pipe *e*, with the lower part K, K, of the exterior casing B, B. The liquids which run down the inside of the neck *a* will thus be separated from the rest and conducted into their receiver. *e*<sup>1</sup>, *e*<sup>1</sup>, *e*<sup>1</sup>, *e*<sup>1</sup>, are four leaves that are attached to the shaft O, and enclosed between two discs, so as to form a kind of bucket wheel.  
25 H is a cylinder keyed on the shaft O on one side of the bucket wheel. *f*, *f*, *f*, *f*, are holes in the side G, through which the liquids escape from the solids on the leaves *e*<sup>1</sup>, *e*<sup>1</sup>, *e*<sup>1</sup>, *e*<sup>1</sup>, to the cylinder H, and thereafter to the gutter K, K, whence they pass to the reservoir. *i*, *i*, is a trumpet-shaped pipe through which the matters on the leaves are precipitated through the pipe J into their  
30 reservoir. The liquids which may have accompanied these matters into the pipe *i*, *i*, run down between its sides and those of the pipe J into the gutter K. *m*, *m*, are glass bearings which support the shaft O. *n* is an iron support soldered to the upper casing A, A, by which the powder box R is sustained.

Figures 20 and 21 are sectional elevations of the apparatus adapted to the  
35 powder box R, for regulating the supply of disinfecting powder therefrom. A is a drum keyed on the shaft O, which has four pins *p*, *p*, *p*, *p*, projecting from the centre of its periphery and placed at equal distances apart. *q*, *q*, *q*, *q*, are other points arranged round each end of the periphery of the drum. S is a sheet of zinc suspended by the upper part from one of the top edges of the



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powder box, which is fitted at bottom with a strip of steel that serves as a point of contact for the pins  $p, p, p, p$ .  $V, V$ , are openings in the sheet of zinc to allow of the passage through them of the points  $q, q$ , which scrape down the powder.  $X, X$ , are two prolongations of the zinc sheet which cover the spaces between the sides of the powder box and the ends of the drum. The elasticity of the sheet of zinc which is brought into action by the rotation of the drum shakes up the powder and prevents its clogging. The drum turns with the bucket wheel, and is fitted with glass bearings like the casing to diminish resistance to the rotation of the shaft produced by increased friction arising from the oxydation of metals.

Figure 22 is an elevation of a portable watercloset constructed on the same principle as the one last herein-before described, in which similar letters indicate similar parts, and differs from it only in having adapted to the respective outfalls moveable receivers for keeping the liquids and solids separate.

Figure 23 (a sectional elevation), Figure 24 (a top plan), represent another of my improved waterclosets.  $A, A$ , is the opening of the upper part  $A^1$  of the exterior casing, which is adapted to the outfall of the main drain.  $J$  is the lower part of the exterior casing, which is of the rectangular form shewn in the Drawings. The ends of the casing which come opposite one another are flanged, whereby they are bolted or riveted together at  $X$ .  $D$  is a vessel which has two of its opposite sides flat and the other two curved, and is contracted at top and bottom; this vessel is placed inside the casings  $B, J$ , with its opening exactly under the opening  $A, A$ , of the neck. The lower part of the vessel  $D$  has its two curved sides enlarged, as shewn at  $O$ , and its edges turned up at right angles to encircle and hold the lipped pipe  $M$ , which opens at bottom into the solids' receiver. These sides are perforated with numerous holes, through which the liquids which fall into the vessel  $D$ , escape into the exterior casing  $J, J$ , and thence through the pipe  $L$ , to their reservoir.  $E, E$ , are two sheets of metal, which are united at top and form an acute angle  $O^1$ ; the lower ends of the sheets are bent inwards and then turned up to form two gutters  $F, F$ . These sheets are supported inside the vessel  $D$ , with the angle  $O^1$  extending right across the opening thereof, and their edges are in contact with the flat sides. One of these sides is perforated with two holes opposite the respective ends of the gutters  $F, F$ , to which are fitted the two ends of the pipe  $G$ .  $H$  is a vertical pipe, which opens into the centre of the pipe  $G$ , and terminates at bottom in the space between the exterior casing  $J$  and the vessel  $D$ . The solids and fluids which fall from the waterclosets or drains pass through the opening  $A, A$ , of the neck, when a portion of the liquids will run down the sides of  $A^1$  into the intercepting gutter  $C$ , whence they will escape by the pipes  $K$  and  $L$



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to the liquids' receiver; the rest will fall through the opening of the vessel D on to the sides of the angular piece E, and the solids slide off at the entering portions on to the contracted sides of the vessel D, and from them again into the lipped pipe M, which will convey them to their receiver, while the rest of the  
 5 liquids will run down the sides into the gutters F, F, and thence by the pipes G, H, and L, to their receiver.

Figure 25 represents a modification of the preceding construction of apparatus. A is the main drain, with its outfall exactly over the opening of the conical vessel B, B, which is constructed and fitted in a manner similar  
 10 to the vessel D lastly herein-before described, with the exception that it is provided with two outfalls D, D, for the solids. X is the angular piece which is suspended in the conical vessel B, and guides the solid matters through the lipped pipes C, C, and D, D, into their receiver, and the liquids which run down the sides of the vessel B between them and those of the lipped pipes C  
 15 through the holes E, E, into the exterior casing F, F, whence they escape by the pipe G to their receiver. N is a clack valve supported between one side of the angular piece X and the opposite side of the vessel B, which is forced back by the pressure of the solids against it in their descent, and then actuates the catch M, the free and top end of which takes into the teeth of the ratchet  
 20 wheel I. The powder box J is keyed on the axle R of the ratchet wheel I, and turns with it; the axle R turns in bearings in the cross bar H, which is supported by the bracket P. Each partial revolution of the powder box produced by the opening of the clack valve N (which forces the catch M up between two of the teeth of the detent, whereby it will be forced one tooth round),  
 25 discharges a certain determinate quantity of powder through the openings y, y, into the pipe L, which passes through the angular piece X, and then branches off into two pipes L<sup>1</sup>, L<sup>1</sup>, which open respectively into the outfall pipes D. The disinfecting powder will be conducted through the branch pipes L<sup>1</sup>, L<sup>1</sup>, and outflow pipes D, D, into the receivers of solids. O is a spring made fast to the side of  
 30 the casing which presses against the under side of the catch M, and prevents it from falling down.

Figure 26 is a sectional elevation, and Figure 28 a cross section, of another watercloset constructed according to my Invention. A, A, A, A, is the casing. A<sup>1</sup>, the neck, which is adapted to the outfall of the drain.  
 35 One of the sides of the casing is curved inwards, as shewn in the Drawings, and the rest are flat. B is a box underneath the fall A<sup>1</sup>, one side of which is composed of the curved portion F, the other two of plates inside of which are the vertical bars F<sup>1</sup>, F<sup>1</sup>, or perforated plates. The bottom is composed of the moveable plate F<sup>2</sup>, which comes in contact with the curved



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side F. The matters which fall through the opening  $A^1$  are received into the angle formed by the flap  $F^2$  and the curved side F, where the solids remain, while the liquids escape through the spaces between the vertical bars  $F^1$ , placed on either side of the flap, into gutters  $y, y$ , on each side of the side plates, through which they pass to the receiver. The box B is attached at top to 5 a transversal shaft V, connected to one end of an oscillating lever G, which is weighted at the other by the counterbalance weight X. The plate U is attached to the lever midway between its fulcrum and the counterbalance weight X, and is made fast at top to a coiled spring, which keeps the weighted end of the lever up, and thereby keeps the moveable flap  $F^2$  against the curved 10 side F. The liquids which escape between the curved side F and the flap  $F^2$  will run down the curved side of the casing into the bottom, and through the pipe H to the liquid receiver. Z is a cord attached to the door of the water-closet, which is divided at a certain point for the remainder of its length into two parts, one of which passes over the pulleys W and D, and is attached to 15 the free end of the spring, and the other passes round the pulley R, Figure 27, (keyed on the top of the vertical rod Q, which rotates within the powder box P,) and over the pulley T, when it is made fast to the counterbalance weight U. When the door of the watercloset is shut the cord Z is pulled light and the flap  $F^2$  drawn up to close the box B; but when the door is 20 opened the counterbalance weights X and U come into play. The first will descend and raise the opposite end of the lever G, and throw down the flap  $F^2$ , whereby the solids will slide off the flap into the lipped pipe  $G^1$ , and thence to their receiver, and the second U will also descend and consequently cause the vertical rod to rotate, which will bring one of the slots in the disc  $Z^2$ , 25 attached to the bottom of the rod, over the outflow B, and thus allow the dose of disinfecting powder to pass into the receiver for solids. The vertical rod is furnished with a number of cross pieces, which move round with it, and agitate the powder to secure its flowing freely. M and N are two openings in the exterior casing to allow of access to the interior of the apparatus for the 30 purpose of cleansing the different parts.

Figure 29 is a sectional elevation of another arrangement of apparatus for effecting the separation of the liquids from the solids of fecal substances. B is the exterior casing. A, the pan. R, a plate with raised edges (except on the forepart), which are pierced with numerous small holes, 35 and outside of these edges are gutters. The plate is made fast to a vibrating shaft I, on which is keyed the rod J, which projects through a slot in the fixed part of the cover, and is attached to the back of the moveable part H. When the cover is lifted up the plate R is brought up;



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being inclined backwards so as to close the pan A, and receive the liquid and solid deposits, a portion of the liquids will pass through the openings in the edges of the plate into the gutters and pass by the orifices G and E (in the latter) into the bottom of the casing B, whence they will flow through the pipe  
 5 F into the liquids' receiver. When the lid is afterwards shut down the fore part of the plate is lowered into the lipped pipe C, whereby the solids will slide off into this latter and fall through it into their receiver. The remaining liquids which are made to impinge against the sides of the pipe C run down them, and are received into a gutter-like ledge formed on the inside of the  
 10 pipe. Holes are made in the sides of the pipe on a level with the bottom of the gutter in order that the liquids may flow through them into the bottom B, B, and thence through F to their receiver. The movement of the lid also works the powder box or cylinder O, which is constructed like the one before described, by means of a catch K, to which a chain M is attached that is made  
 15 fast at the other end to a rod L, projecting from the powder box or cylinder O. When the lid is put down it draws up the chain and thereby causes the box or cylinder to make one third of a revolution, whereby a determinate portion of powder will be discharged through the pipe N into the receiver of solids.

Figure 30 is a sectional elevation; Figure 31, a cross section; and Figure 32,  
 20 a longitudinal section of another of my improved waterclosets. A is a step which vibrates on the pin O, in front of the seat. D, E, F, G, are a series of jointed levers connected together as shewn in the Drawings. H is the lid which turns with the spindle E<sup>1</sup>; I, the pan; J, pipe leading from the powder box; K, the spindle of the valve L, on which the fecal matters are deposited,  
 25 and which has three of its edges turned up. This valve serves to close the outfall of the pan, in which case it is inclined from the flat or smooth edge towards the back. N is the outfall communicating with the reservoir for fecal matters. O is a rod, keyed either on the valve spindle or on the spindle of the seat H, which works the outflow pipes of three reservoirs placed above  
 30 one containing the disinfecting powder for the solids, a second water to wash the pan, and a third some disinfecting liquid agent to act on the liquids of the fecal matters without affecting their fluidity. When the watercloset is to be used, the step A is depressed, whereby, through the system of jointed levers shewn in the Drawings, the seat H will be raised, and the outfall of the pan  
 35 closed by the valve L. The liquids which are received with the solids on to the valve will run off its inclined surface down the back M, through the pipe N<sup>1</sup>, into their reservoir. Each time that the lid is moved up or down motion will be communicated to the powder box, whereby a portion will be discharged. This system of levers may be made to open a ventilating valve



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communicating with the receivers, and two valves may be employed, the one to shut when the second opens, and vice versâ.

Secondly, my Invention consists of a peculiar construction and arrangement of apparatus, in combination with a waggon or carriage, for emptying the receivers of fecal matters of their contents, and transporting them to any 5 required distance. In this part of my Invention I dispense with the employment of both hand labor and steam to create the vacuum for exhausting the matters from their receivers into the carriage, and create the vacuum by means of an air pump, which is worked by the progress of the carriage from the manure depository to the place from which the fecal matters are to be brought. 10 Figure 33 is a side elevation, Figure 34, a front end view, and Figure 35 a top plan, of a portion of an apparatus, constructed according to this part of my Invention. The arrangement and construction of parts being the same on both sides of the carriage, with the exception of the pitch chain and wheels, I shall, for the sake of brevity, describe those on one side only; 1 is one of the large 15 hind wheels, on the nave of which there is made fast a pitch wheel 3, which gears into an endless pitch chain 2, which passes round and gears into the pitch wheel 6, keyed on the shaft 7, which works the pump. The pitch chain passes over two rollers 4 and 5 to prevent its slackening in the event of the springs giving way. As the waggon is dragged forward the pitch chain travels 20 round and causes the pitch wheel 6 to revolve, whereby the main driving shaft before mentioned is made to rotate. The main shaft is made with cranks, to which are attached connecting rods 9, made fast to the cross head 10 of the piston rod 11. 12, 12, are two sockets attached to each side of the piston rod which slide over two guide rods made fast to the cylinder of the pump, in 25 order to keep the motion of the piston regular and parallel, and prevents its partaking of any of the eccentricity of motion of the connecting rods. The nave of the other hind wheel is furnished with a smooth pulley, as well also as the other extremity of the cranked driving shaft 7. A leather or other driving band is passed round these two pulleys, and serves by its frictional 30 contact to maintain the communication of rotary motion from the hind wheel to the driving shaft when the carriage is turned round on the side of the pitch chain. The air pump is placed under the seat of the carriage, as shewn at A, Figure 33, and communicates with the air-tight body of the carriage or vessel B by means of an opening made in the centre of the lower part of the fore end 35 of the said vessel. The pump, which is both lifting and forcing, is about six inches in diameter and twelve inches high. The barrel is encircled by five metal rings 14, to increase its resisting power, and the top and bottom, which are each composed of two concave pieces, as shewn in the Drawing, are bolted



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to the sides. The concave pieces opposite each other are made to communicate by means of the vertical tubes 17, 17, placed on either side of the pump barrel. The concave pieces are each furnished with a valve opening above and beneath the piston, and the tubes 17 are likewise fitted with valves at each extremity opening into the concave pieces. 20 and 21 are openings in the sides of the tubes 17, 17. The opening 20 has the cock 22 connected to it to allow of the passage of air. The metal piston is turned true and fitted to a rod of steel, which is furnished at top with a brass bearing, to connect it to the cross head 10. This piston is about four inches deep, and of a diameter to suit that of the cylinder, in order that it may work freely and easily, but air tight therein. If the length of the piston be subtracted from the length of the barrel, and the remainder eight inches be multiplied by the superficial area of the piston (six inches being the diameter), the result will give us the available cubical contents of the barrel, two hundred and twenty-four cubical inches; whence it follows that four hundred and forty-eight cubical inches will be displaced at each stroke of the plunger or revolution of the wheel (for both pitch wheels are of the same diameter and have the same number of projections or teeth). The capacity of the body of the carriage or vessel is about fifty-three cubical feet, and, allowing seven cubical feet for loss by leakage at the points of junction of the apparatus, there will be sixty cubical feet to displace to effect the vacuum. The pump exhausts four hundred and forty-eight cubical inches at each revolution of the hind wheel, which is about thirteen feet in circumference, so that the carriage will have to travel over about three thousand feet, which, with three horses harnessed to it, will take ten minutes to do. When the vacuum is completed as far as practicable it will be indicated to the coachman by a whistle, which will be blown by the entry of air when the external pressure of the atmosphere overcomes the resistance of the spring which keeps the safety valve 49 closed. When this occurs he turns the handle of the valve spindle 23, and cuts off communication between the body of the carriage and the air pump. The spindle passes through the valve, and causes at bottom a pinion 24 (see Figure 36), into which gear on either side in front and behind two toothed racks 25, 26. The other ends of these racks are made with rings 28, which encircle the collars cast on the inside of the pitch wheels, and allow them to turn freely therein. 29, 29, are feathers on the main driving shaft. The bosses of the collars are made of larger diameter than the main driving shaft, and with grooves to correspond to the feathers, as shewn in Figure 37. When the valve spindle is turned to open a communication between the pump and the body of the carriage the rotation of the pinion will draw the racks towards one another, and cause the collar and pitch wheels 6, 6, to slide inwards along the shaft over



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the feathers, which will have the effect of making the shaft revolve with the pitch wheels. When the vacuum is completed, or from other causes it is inexpedient to continue working the air pump, communication is cut off between the pump and the body of the carriage. To do this, the valve spindle will have to be turned in the reverse direction, whereby the racks will recede from one another, and slide the pitch wheels off the feathers to the outside ends of the shaft, on which they will turn loosely, without imparting to any motion whatsoever. 50 is a cock, which is to be shut when the vacuum is made, and opened when the machine is being emptied; and 51 is the pipe for the inflow of the fecal matters; 53 is a manhole in the vessel, and 54 the cover. 5

Thirdly, my Invention consists of a peculiar construction of cock and valve for waggon of the kind lastly herein-before described. In Figures 38, 39, 40, 41, and 42, 0, 11, and 10, represent three cylinders. The first or main cylinder is pierced with two holes 4 and 5, to which two pipes are attached, which communicate respectively with the reservoir of fecal matters and a furnace, which is lighted and placed on the pavement during the operation of filling the waggon, for the purpose of consuming the noxious gases as they ascend into the waggon. The second cylinder 11 is placed within the first, and fits accurately therein. It is pierced with one hole (15) only, which is on a level with the opening of the pipe 5. The third cylinder 10 is placed within the second, with a space all round between the two of about one third of an inch, more or less, to allow of the passage of air, and is also pierced with a hole (on a level with the opening of the pipe 4), to which a pipe is attached that passes through the cylinder 11, and is soldered to the end of the pipe 4. The fecal matters pass into the vessel through the pipe 4 and the barrel 10, which projects above the cylinder 11, and is closed in at top. The latter is attached to two arms, which are united to a cross head above the cylinder 10. A rod 3, fitted with a handle passing through a hole in the cover of the cylinder 0, is attached to the cross head, whereby the cylinder 11 may be turned round so as to bring the opening 15 opposite the pipe 5, or not, as may be required, and consequently establish or cut off the communication; 7 is a wedged-shaped catch attached to the lower part of the cylinder 11, which, when the latter is turned round, comes in contact with the top of the valve spindle 8, and gradually depresses it, whereby the valve will be raised and the cylinder 10 closed, so as to keep whatever matters the cock and the supply pipe may contain from falling out when it is removed from one vessel to another. The valve is fixed to the body of the cart by means of the bayonet joints 13, 12, 13, 12. 10 15 20 25 30 35

Fourthly, my Invention consists of the several compounds herein-after described for the disinfection of fecal matters.



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## COMPOUNDS FOR DISINFECTING THE WATER OF STREET DRAINS.

In these compounds the proportions of ingredients herein-after mentioned are calculated for one hundred gallons of the fluid to be disinfected.

First compound.—To 56 ounces of pounded stone add 6 ounces of each of 5 the following chemical ingredients: alum, marine salt, sulphate of zinc, and burnt lime. The whole to be mixed well together.

Second compound.—To 7 lbs. of pounded bricks add 6 ounces of each of the following substances: alum, marine salt, and sulphate of zinc.

Third compound.—Gypsum reduced to powder is to be mixed with the 10 chemical substances used in the second compound in the same quantities as before.

Fourth compound.—The same chemical products as before, and in the same proportions as before, are mixed with 7 lbs. of the residuum of schistus reduced to powder.

15 Fifth compound.—7 lbs. of old plaster (such as is obtained from the taking down of old houses) are to be mixed with chemical products, all as before.

Sixth compound.—7 lbs of white sand mixed with the same chemical products, and in the same proportions as in the first compound.

20 COMPOUNDS FOR DISINFECTING THE LIQUID PORTIONS OF FECAL MATTERS FROM WATERCLOSETS.

Add to any one of the six compounds previously described 6 ounces of sulphate of iron, 2 ounces of pyrolignite, and 2 ounces of manganese.

## COMPOUNDS FOR DISINFECTING SOLID OR SEMI-SOLID FECAL MATTERS.

25 Some of these compounds are in a liquid state, others in a state of powder, and sometimes a liquid and a powder may be used together.

First compound (a disinfecting liquid).—Thick copperas water.

Second compound.—Pyrolignite of soda and creosote (when the fecal matters are not intended to be afterwards used as manures).

30 Third compound (disinfecting fluid).—To one thousand parts of water add one hundred and twenty-five parts of nitrate of lead, and thirty-two parts of acetate of lead.

Fourth compound.—Take about 77 lbs. nitric acid, of 36° Beaume, and about 55 lbs. subcarbonate of lead, and dilute with pure water till the mixture is reduced to 17° Beaumé.

35 Fifth compound.—For every one hundred parts of matter to be disinfected, take three per cent. parts of sulphate of zinc, four per cent. of carbonate of lead, three parts sulphuric acid, and, in stormy or frosty weather, add four per cent. marine salt, dissolved in twenty-five per cent. pure water.



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Sixth compound.—Three per cent. sulphate of potash; fifteen per cent. charcoal dust; eight per cent. sulphate of iron; two per cent. copper; two per cent. alum.

Seventh compound.—Sulphate of manganese, lime water, sulphuric acid, muriatic acid. 5

Eighth compound (disinfecting liquid).—To about 176 quarts of water add about 44 lbs. of sulphate of iron, 11 lbs. of sulphate of zinc, 4 lbs. of sulphate of copper, 4 lbs. of alum, 44 lbs. of charcoal dust, then reduce the whole to powder, and dissolve the mass; next mix it with about 176 quarts of water, and add 4 lbs. of sulphuric acid. These proportions are sufficient for rather 10 more than 1365 cubic inches of liquid matter, or rather more than 975 cubic inches of semi-solid matter.

Ninth compound.—To about 2 quarts of water add about 2 lbs. of carbonic acid, about  $6\frac{1}{2}$  lbs. of salt of soda, about 4 lbs. Glauber salt, and about 44 quarts of acidulated water or metallic washings. The above quantities are about 15 sufficient for 1560 cubic inches of fecal matters in a state of fermentation.

Tenth compound, for urine only.—Take about 2 lbs. sulphate of zinc, 2 lbs. of alum, 2 lbs. of lees or dregs of wine in a fresh state, and about a quart of vinegar; add about 4 quarts of water, and dissolve the whole well. I use this compound in the proportion of  $\frac{1}{100}$ th of a quart of the compound to 1 quart 20 of urine, that is, at the rate of 1 per cent.

Eleventh compound.—Take about 2 lbs. sulphate of zinc, the same quantity of alum, and twice that quantity of sulphate of iron, together with  $\frac{1}{2}$  an ounce of camphor, and rather less than a quart (say  $1\frac{3}{4}$  pint) of spirit of wine; dissolve the whole in about 9 or 10 quarts of water. One per cent. of this com- 25 pound will suffice to disinfect urine in a fresh state.

Twelfth compound.—Take  $\frac{1}{2}$  an ounce of camphor, about  $2\frac{1}{4}$  lbs. of muriatic acid, the same quantity of saltpetre, the same quantity of alum, and the same quantity of chlorine, and dissolve in about 10 quarts of water.

Thirteenth compound.—For the preservation of urine for the purposes of 30 commerce, for washing stuffs, and irrigating fields, &c., I use the following compound: about 2 lbs. of marine salt, 2 lbs. of salt of soda, 2 lbs. of alum, rather less than a tenth of a quart of spirit of wine, or about  $3\frac{1}{2}$  gills of good vinegar, and about 8 quarts of water. One hundredth part of a quart of this compound will serve for a quart of urine.

Fourteenth compound.—Sesquioxide of iron, acetate of lead, azotic acid, alumina, and sulphate of zinc. 35

Fifteenth compound.—Oxide of zinc, manganese, pech blende, calcalyte, oxide of tellurium. When urine has been disinfected by any of these com-



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pounds it may be used for washing linen and other stuffs, and afterwards, in order to fit it for garden and agricultural purposes, sal ammoniac should be added in the proportion of about 4 lbs. to 176.08 quarts of urine, and a like quantity of rain water or river water.

## 5 DISINFECTING POWDERS.

First powder.—Take of charcoal dust, breeze cinders or furnace ashes, and old plaster, about 110 lbs. each; to these add about 22 lbs. of marine salt, and the same quantity of alum, together with half that quantity of sulphate of zinc, about 4 lbs. of saltpetre, and about 29 lbs. of copperas.

10 Second compound.—About 176 lbs. of waste tan, slightly carbonized, about 22 lbs. of sulphate of iron, 154 lbs. old plaster, 9 lbs. sulphate of zinc,  $4\frac{1}{2}$  lbs. sulphate of copper, 9 lbs. alumina, 11 lbs.  $\frac{1}{2}$  marine salt.

Third powder.—About 39 lbs. coal ash, 176 lbs. sawdust, slightly carbonized, about 88 lbs. marle, about 88 lbs. prepared plaster, 22 lbs. sulphate of iron, 15 11 lbs. sulphate of zinc,  $11\frac{1}{2}$  alumina, 4 lbs. saltpetre.

Fourth powder.—About 1543 lbs. of bone dust, slightly carbonized, 110 lbs. dried barren earth, 33 lbs. sulphate of iron, 11 lbs. sulphate of zinc, 4 lbs. alumina,  $6\frac{1}{2}$  lbs. Glauber salt, 11 lbs. marine salt.

Fifth powder.—About 220 lbs. (nearly 2 cwts.) residuum of schistus reduced 20 to powder, 55 lbs. clay or marl, 110 lbs. old plaster, 11 lbs. alumina, 11 lbs. sulphate of zinc, 22 lbs. marine salt, 11 lbs. saltpetre.

Sixth compound.—About 220 lbs. turf ashes or carbonized turf, 110 lbs. carbonized clay, 11 lbs. chaff (straw of hay) or barn dust, 22 lbs. marine salt, 11 lbs. alumina, 33 lbs. sulphate of iron, 11 lbs. sulphate of zinc.

25 Seventh powder.—About 220 lbs. coke dust, 110 lbs. house, street, or road sweepings, 110 lbs. saltpetre, 22 lbs. marine salt,  $17\frac{1}{2}$  lbs. oxide of zinc,  $17\frac{1}{2}$  lbs. alumina, 42 lbs. prepared plaster or dry clay.

Eighth compound.—About 198 lbs. of soot, 110 lbs. oyster shells reduced to powder, or other calcareous substance; 33 lbs. dried barren earth, 22 lbs. 30 alumina, 22 lbs. marine salt, 33 lbs. sulphate of iron, 11 lbs. sulphate of zinc, 11 lbs. saltpetre.

Ninth powder.—About 220 lbs. of the residuum of exhausted dye woods, or other like materials, the same being first carbonized and deprived of its gas (which may be used for lighting purposes); 110 lbs. crude plaster, 66 lbs. 35 residuum of sugar refineries, 22 lbs. alumina, 22 lbs. sulphate of iron.

Fifthly, my Invention consists in the manufacture of a manure resembling guano in its fertilizing qualities, which is applicable to calcareous and sandy and alluvial soils, and which I call urban guano. It is composed of 200 lbs. of



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bestial dung, 100 lbs. of road scrapings or street sweepings, 100 lbs. of marl, 100 lbs. of fecal substances, 100 lbs. of the residuum from the manufacture of schistus, or of peat, turf, or wood charcoal, ground to powder, or of soot, 20 lbs. of marine salt, 15 lbs. of saltpetre, 10 lbs. of alumina, 5 lbs. of sulphate of zinc, and about 10 gallons of water. The whole is intimately mixed together, 5 moulded into bricks, and dried, after which it is reduced to powder, and spread on the ground when it rains, at the rate of 60 bushels, more or less, to about an acre, and ploughed in; when applied a second season, about half the former quantity is used, and if this be done for several successive years an excellent arable land will be thereby obtained, which will afterwards not require 10 manuring oftener than once every three years.

Sixthly, my Invention consists in an arrangement and combination of apparatus for filtering the waters of sewers, which is represented in Figure 43 of the Drawings hereunto annexed. A is the outfall of the sewer, and B a vessel into which the sewage water flows, and thence through the curved pipe C 15 into the reservoir D. E is a pipe opening from about the centre of the reservoir D into the pipe F, which is furnished with a three-way cock F<sup>1</sup>, which is fixed on the spindle P. T is the barrel of the cock. The pipe F opens at bottom into the lower part of the cylinder G, underneath the piston U, and at top above the water wheel J, enclosed within the casing I, which is fitted with 20 an outflow pipe K for the escape of water from the wheel. L is a shoot which receives and guides the disinfecting agent into the interior of the vessel B. N is a vertical shaft, supported at bottom in the bearing K, K, which passes through the stuffing box M in the top of the vessel B, and has attached to its lower part several beaters or mixers O, O. The piston rod V has teeth cut 25 on one side, and passes through the guide box X, gears into the pinion Y keyed on the axle of the toothed wheel Z, which gears into the pinion Y<sup>2</sup>. C, C, are standards which support the bearings of the toothed wheels before described. D<sup>2</sup> is the shaft of the water wheel (supported at the other end in the bearings L<sup>2</sup>, on which is keyed the toothed wheel E<sup>3</sup>, which gears into 30 and drives the toothed wheel F<sup>4</sup> keyed on the shaft of the powder box L<sup>3</sup>, which is constructed after the manner of the one before represented and described, so that it may furnish an intermittent discharge of disinfecting powder through the hopper L to the sewage water in the vessel B, and be intimately mixed therewith by the action of the beaters O. G<sup>1</sup> is a bevilled 35 toothed wheel keyed on the shaft D<sup>2</sup>, which revolves with it and gears into the bevil wheel G<sup>4</sup>, on the top of the vertical rod N, whereby the beaters which it carries will be made to revolve. W, W, are two journals which support the shaft of the water wheel. B<sup>3</sup> is a handle for turning the pinion Y<sup>2</sup>. The



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*Legras's Improvements in the Manufacture of Manure.*

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operation of this apparatus is as follows :—As the water flows into the vessel B, the disinfecting agent is discharged into and intimately mixed with it by the revolution of the beaters ; it then passes into the reservoir D, wherein the impurities are precipitated ; the attendant turns the handle B<sup>3</sup>, and thereby  
5 draws the piston from the bottom to the top of the cylinder ; he then turns the cock F<sup>1</sup>, and opens communication between the reservoir D, the lower part of the pipe F, and the cylinder G ; when the cylinder is filled with water the attendant turns the cock F<sup>1</sup>, so as to cut off communication between the reservoir and the pipe F, and opens it between the cylinder and the upper part of the pipe F ; he then removes a paul from the toothed rack or piston rod, and  
10 allows the piston, which is weighted, to descend, whereby the water will be expelled from the cylinder through the pipe F on the top of the water wheel, and consequently causes it to revolve ; the rotation of the water wheel and its shaft will cause the powder box and beaters to revolve ; when the piston has arrived at the bottom of the cylinder the attendant draws the piston up, and  
15 admits the water beneath as before, and so on for each operation.

Seventhly, my Invention consists in constructing public urinaries and refuse water-sinks in such manner that any liquid matters passing through them may, at the same time, be disinfected. Fig. 44 is a front view, and Fig. 45 a side view of this structure. A is a vessel which may be made oblong, square,  
20 round, or triangular, according as its situation may allow ; it is furnished with three bottoms B, C, and D, the two upper bottoms B and C are moveable, and are perforated with holes of about one sixth of an inch in diameter, like the bottom of a filter ; the third or lowest bottom D is fixed by soldering, and forms the bottom of the whole apparatus. The space E between the second  
25 bottom C and third bottom D forms a reservoir, into which the urine or foul water to be disinfected flows through the holes in the first and second bottoms. When the second bottom is in its place, previous to introducing the upper bottom I cover it with a layer of hay, upon which I lay some charcoal or refuse tan carbonized ; I then add a layer composed of sulphate of iron, sulphate  
30 of zinc, and sulphate of copper, and over the whole I place the upper bottom B. A hole is pierced in one of the sides of the reservoir L about an inch from the bottom, and a pipe G is soldered to this hole, through which the urine or foul water may flow away. A disinfecting liquid apparatus H, such as has been described under a former head of this Specification, may be fixed to the back I  
35 of this urinary or sink, so that the liquid from the apparatus may trickle or run down the whole length of the back, and remove any alkaline or other solid deposit which may have been left or poured thereon. The apparatus can be cleaned out once or twice a week, and the deposits removed and employed for



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*Legras's Improvements in the Manufacture of Manure.*

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urinary purposes. This apparatus may be employed with very great advantage in glue, leather, gut, and other offensive manufactories.

And having now described the nature of my said Invention, and in what manner the same is to be performed, I declare that the improvements, which I claim as constituting my said Invention, are as follows:—

First, I claim the separation of the liquids and solids of fecal substances by means of the apparatuses represented in Figures 1 to 32, inclusive, of the Drawings annexed and before described; that is to say, in so far as by such apparatuses, both projecting and entering curves are presented to fecal matters in their passage from closets or drains to their receptacles, and whether such apparatuses are used in combination with waterclosets of any of the improved forms before described, or adapted to others already constructed and in use. 10

Second, I claim the construction of waterclosets in the different modes represented in the Drawings Figures 4 to 32, inclusive, and before described, (that is to say), in so far as regards the arrangements for discharging dete- 15  
minate quantities of disinfecting powder or liquid into fecal matters, either in the pan of the watercloset or in their receiver.

Third, I claim the peculiar construction of lifting and forcing pump represented in Figure 9 of the Drawings annexed and before described when applied to the transferring of fecal matters from their receiver to a removing 20  
cart or waggon.

Fourth, I claim the vacuum cart or waggon for the removal by exhaustion fecal matters from their receptacle into an air-tight vessel or cart, in so far as regards the application of the rotary motion of the axle of one of the pairs of wheels to the working of the air pump to produce such exhaustion as before 25  
described.

Fifth, I claim the combination of the peculiar construction of air pump aforesaid with my improved vacuum cart represented in Figures 33, 34, 35, 36, and 37, and before described.

Sixth, I claim the peculiar construction of valve represented in Figures 30  
38, 39, 40, 41, and 42 of the Drawings annexed and before described.

Seventh, I claim the application of the residual matters (when carbonised) from the manufacture of schistus into articles of commerce, and combined with any of the alkaline and saline bases and absorbing materials described under the fourth head of this Specification. 35

Eighth, I claim the use of the various compounds described under the fourth head of this Specification for the disinfection of fecal matters and other offensively smelling animal products, but without confining myself to the exact relative proportions there given.



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*Legras's Improvements in the Manufacture of Manure.*

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Ninth, I claim the use and manufacture of the artificial manure described under the fifth head of this Specification, and which I term urban guano, but also without confining myself to the exact relative proportions there given.

Tenth, I claim the apparatus for purifying and disinfecting sewage water  
5 represented in Figure 43 of the Drawings annexed, and before described in the general arrangement and construction thereof.

Eleventh, I claim the construction of public urinaries and waste water-sinks in the manner represented in Figures 44 and 45, as before described.

In witness whereof, I, the said Louis Napoleon Le Gras, have hereunto set  
10 my hand and seal, this Thirtieth day of May, One thousand eight hundred and fifty.

LOUIS NAPOLEON (L.S.) LEGRAS.

AND BE IT REMEMBERED, that on the Thirtieth day of May in the year of our Lord 1850, the aforesaid Louis Napoleon Legras came before our  
15 said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Enrolled the Thirtieth day of May, in the year of our Lord One  
20 thousand eight hundred and fifty.

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LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,  
Printers to the Queen's most Excellent Majesty. 1855.







FIG. 1.

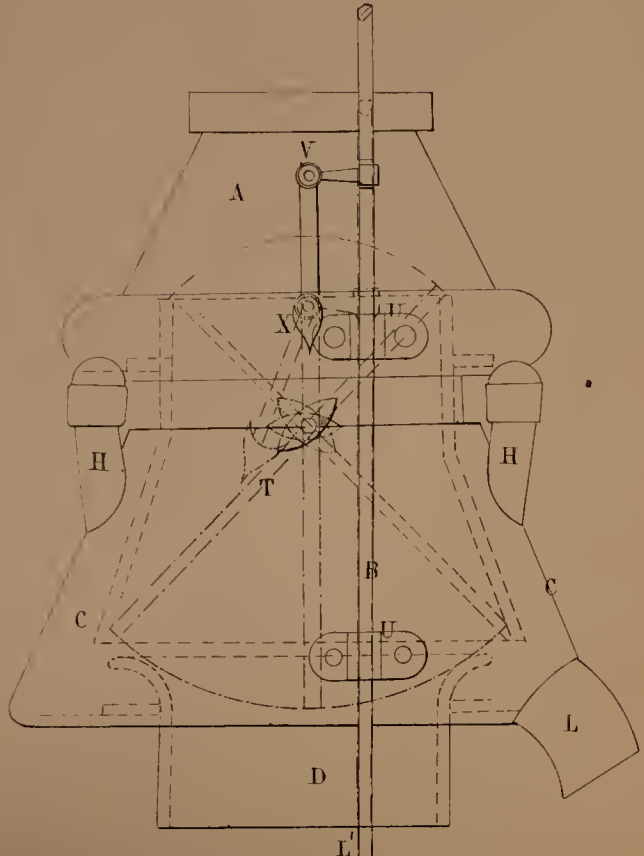


FIG. 2.

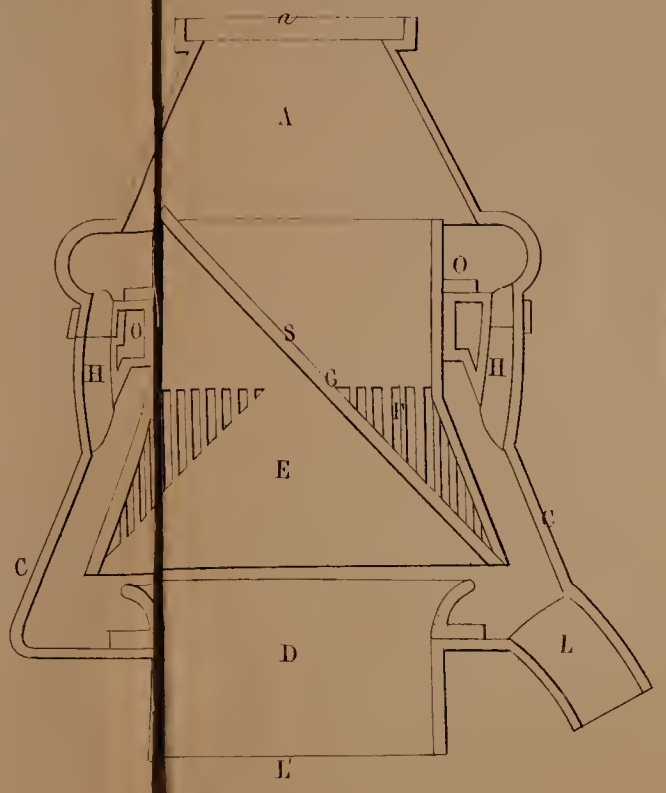


FIG. 4.

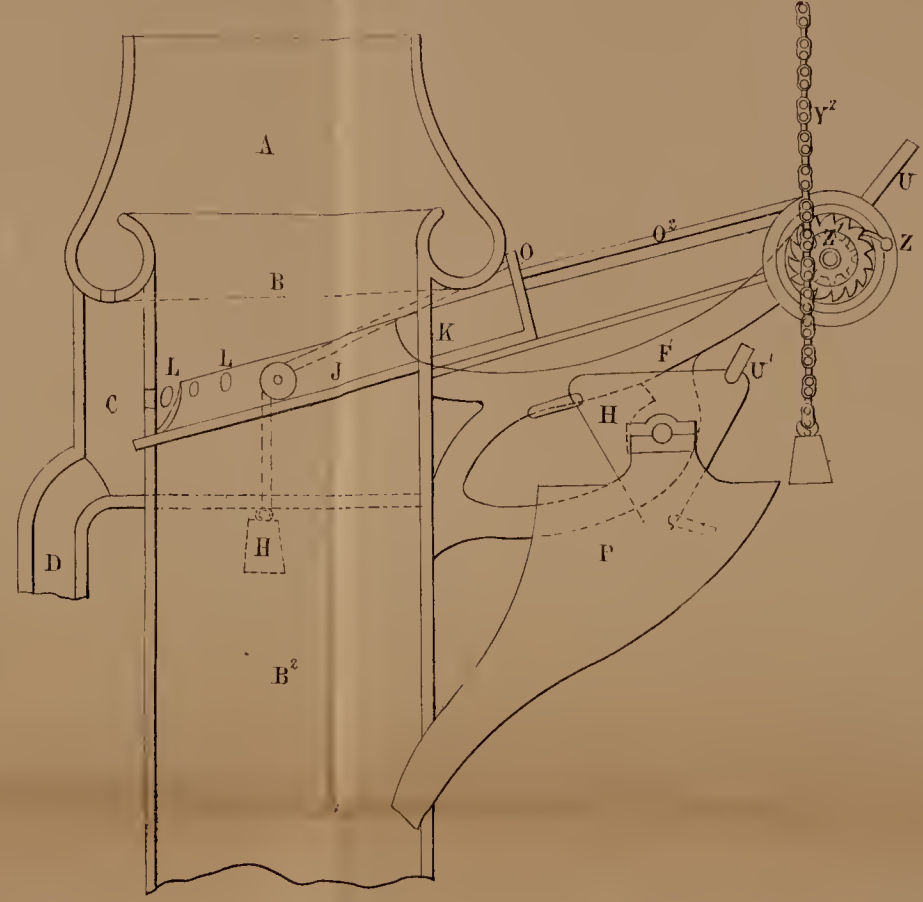


FIG. 3.

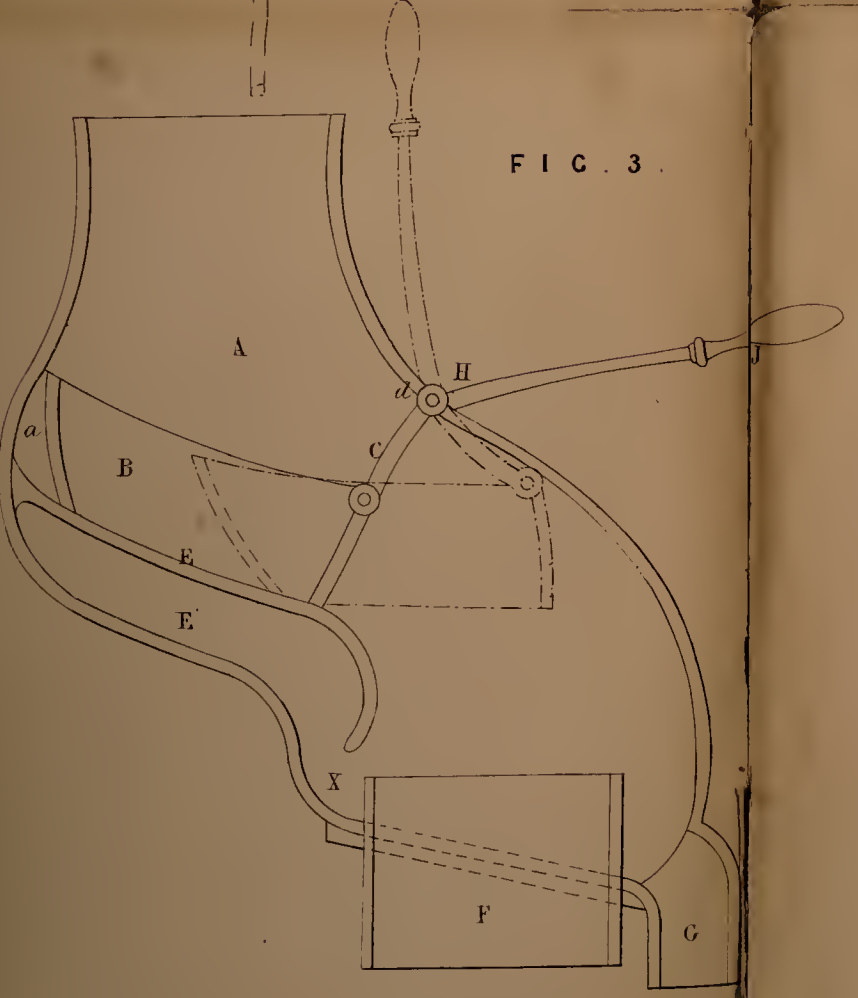


FIG. 5.

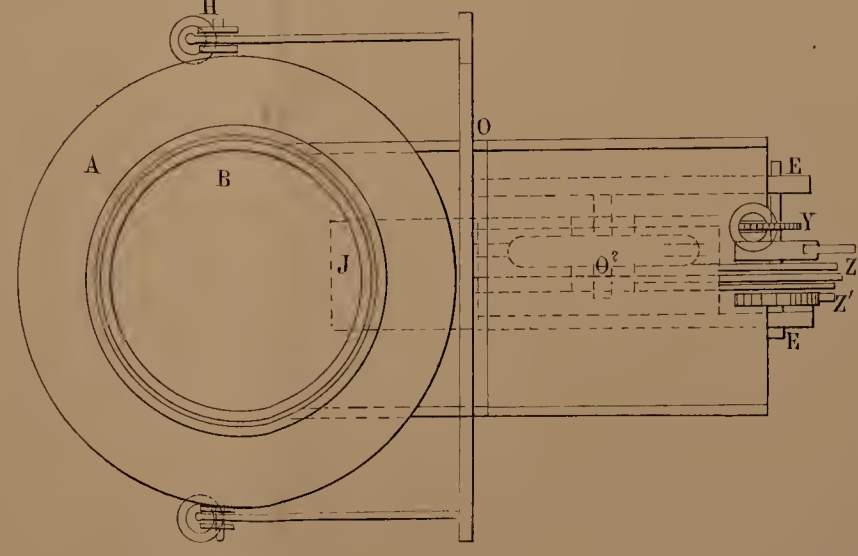


FIG. 7.

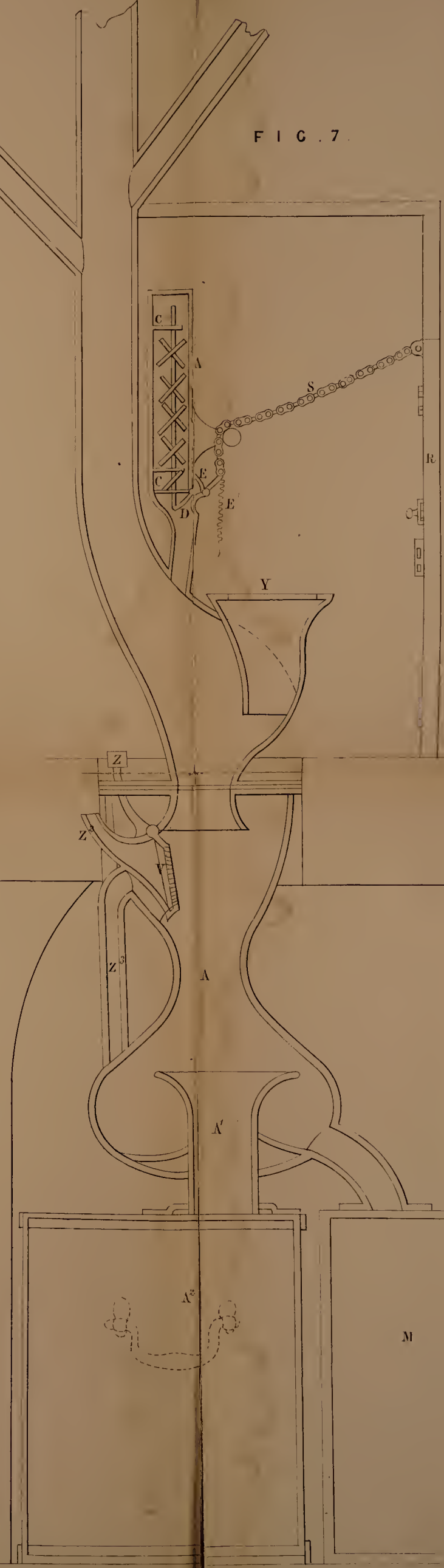


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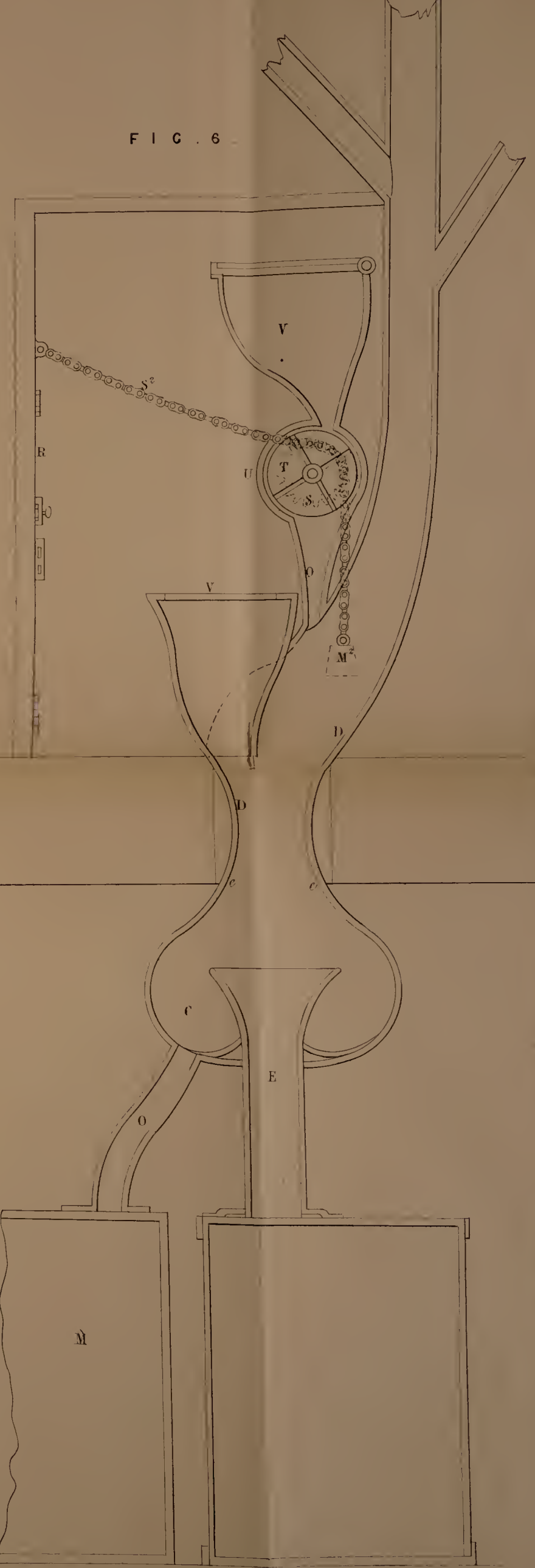








FIG. 11.

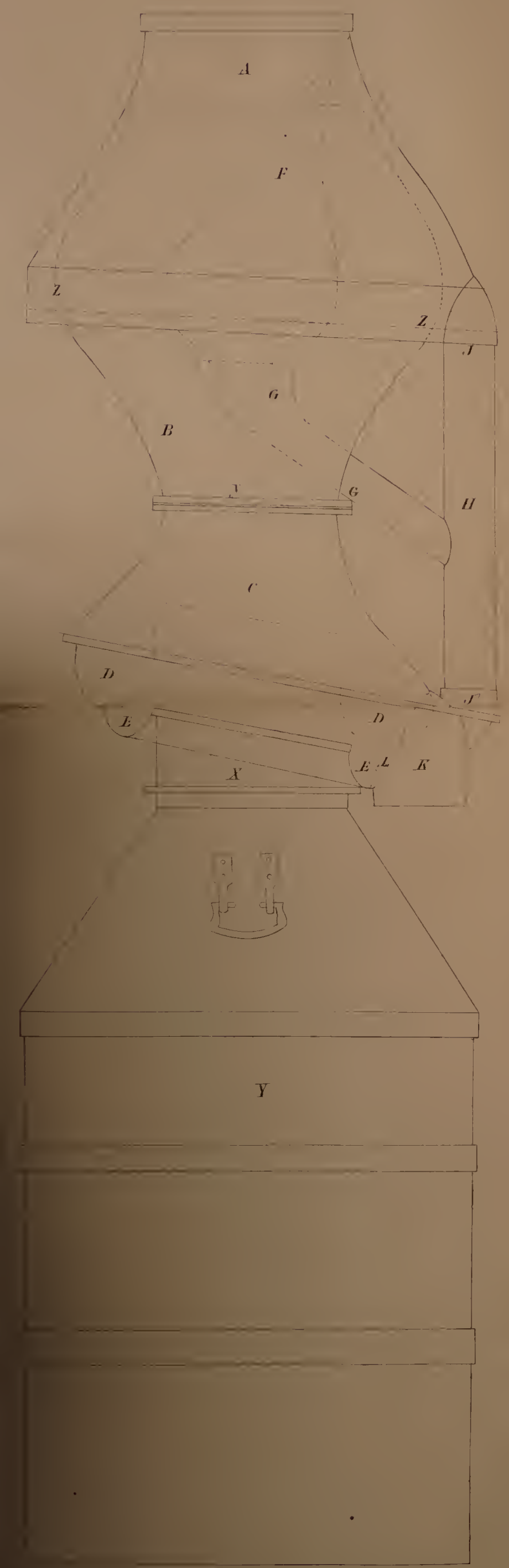


FIG. 14.

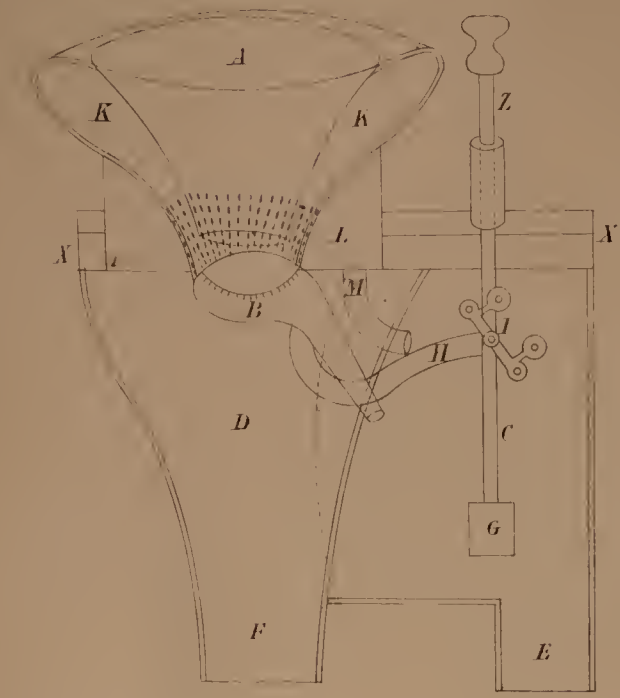


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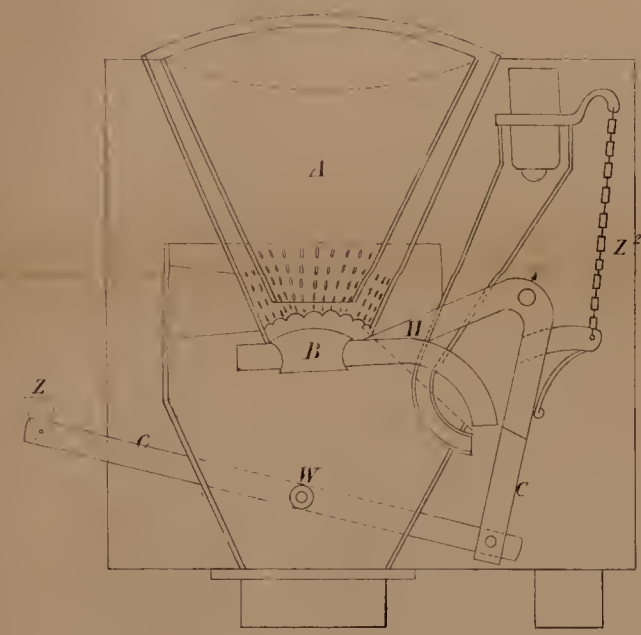


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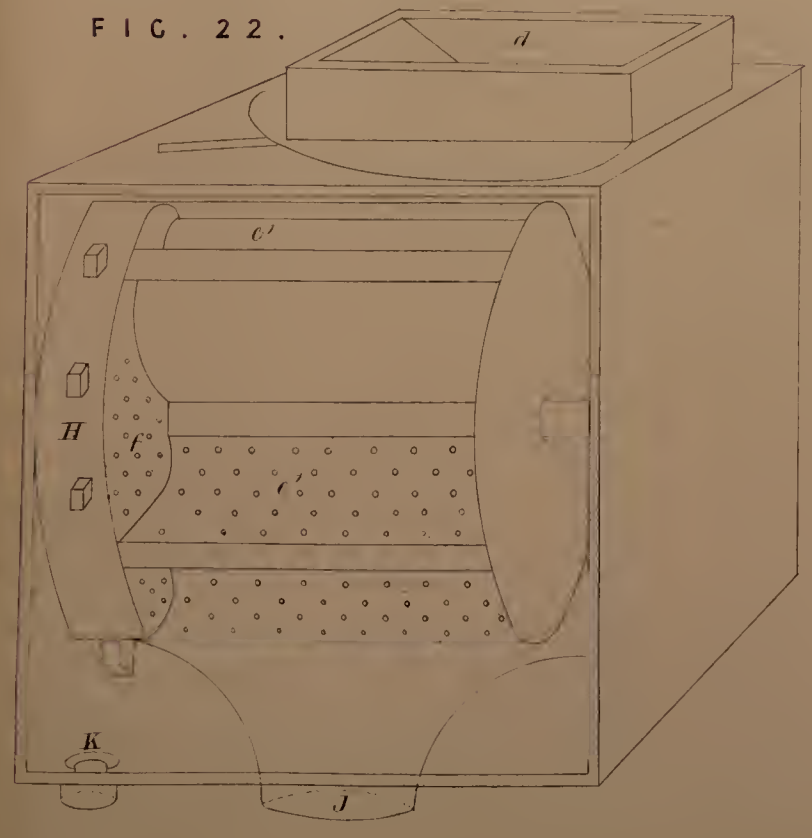


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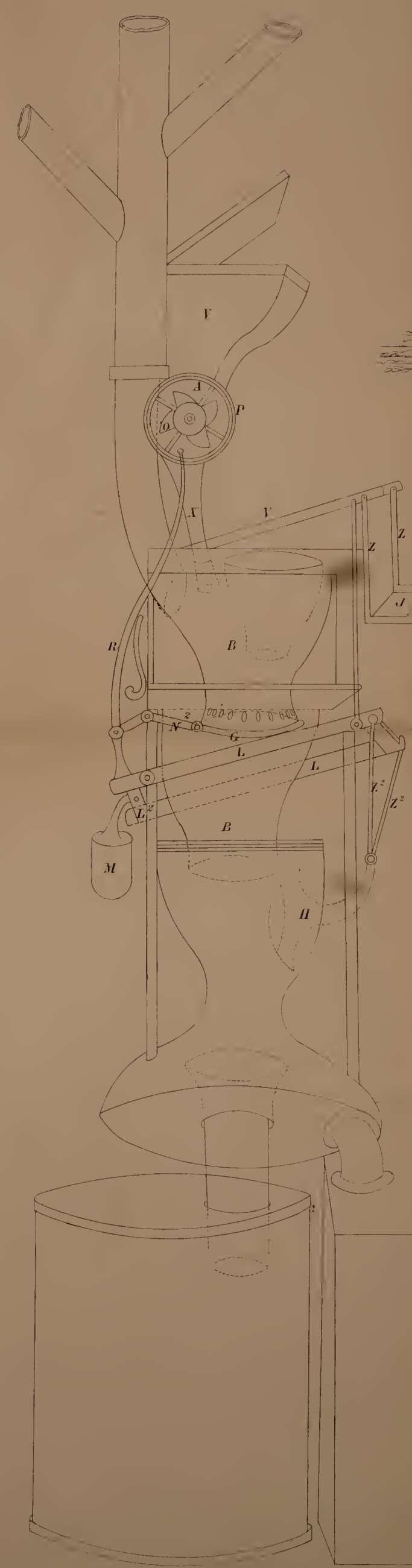


FIG. 10.

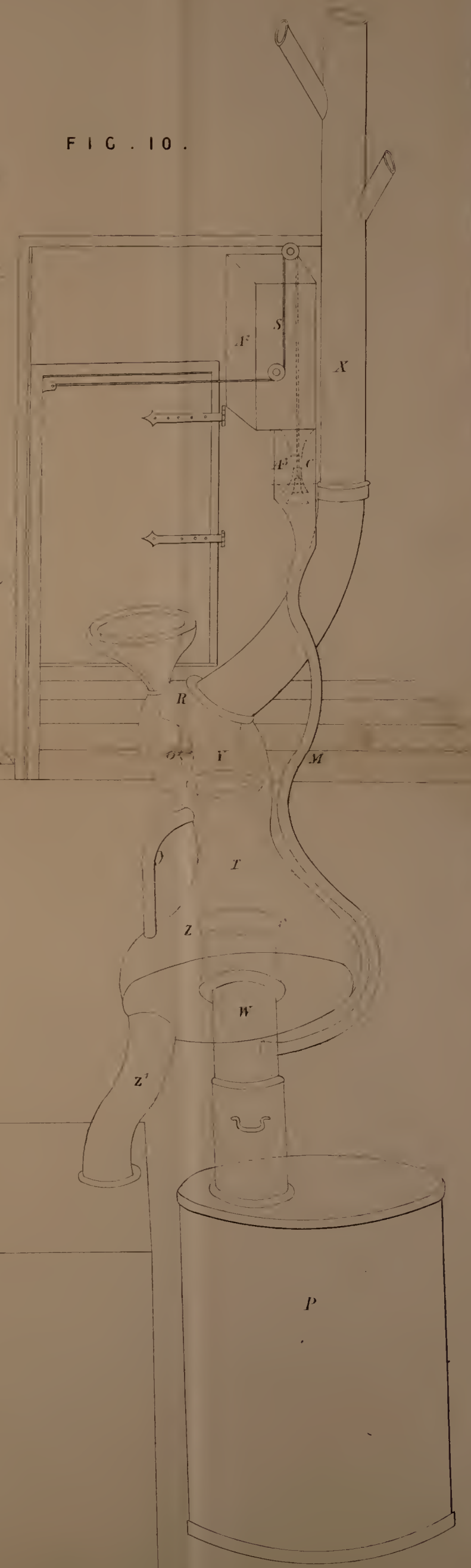


FIG. 9.

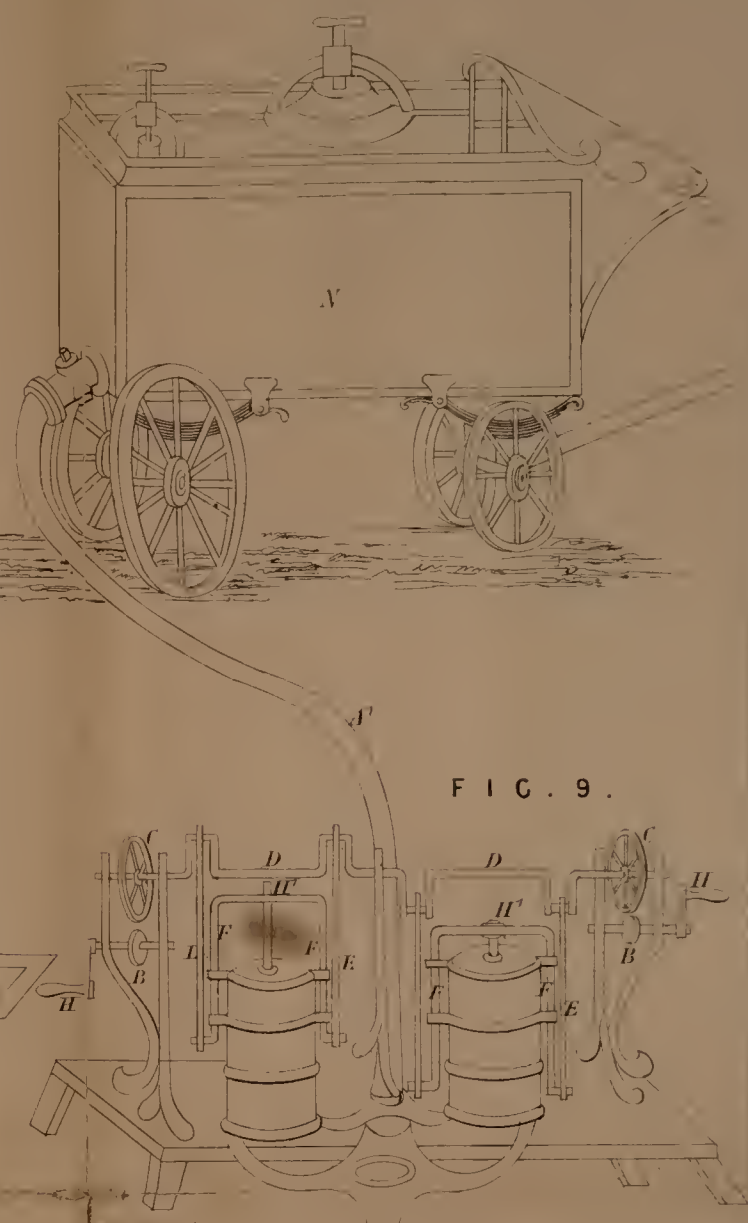








FIG. 12.

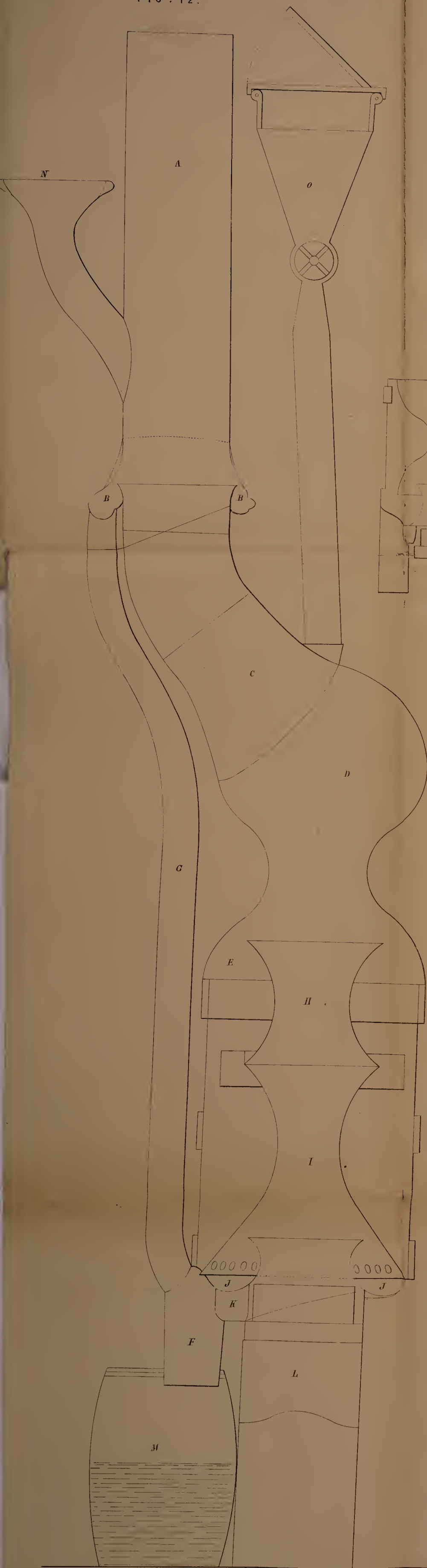


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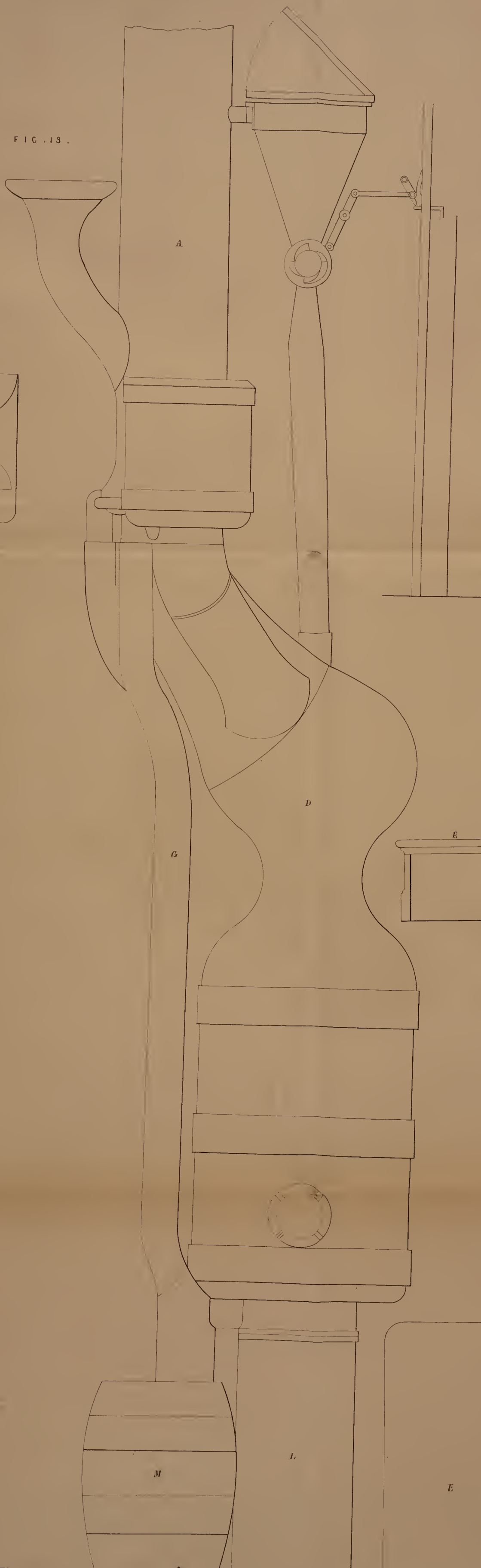


FIG. 17.









A.D. 1849. Nov. 30. N<sup>o</sup> 12,869.  
LE'GRAS' SPECIFICATION.

FIG. 18.

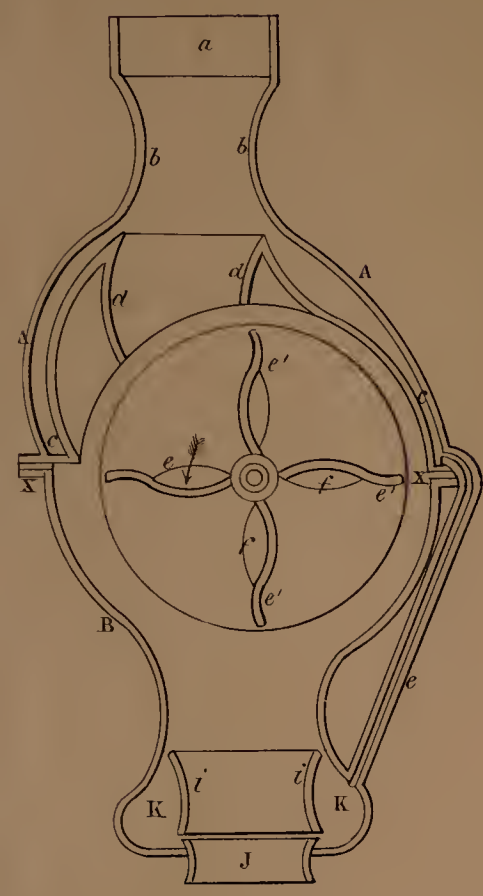


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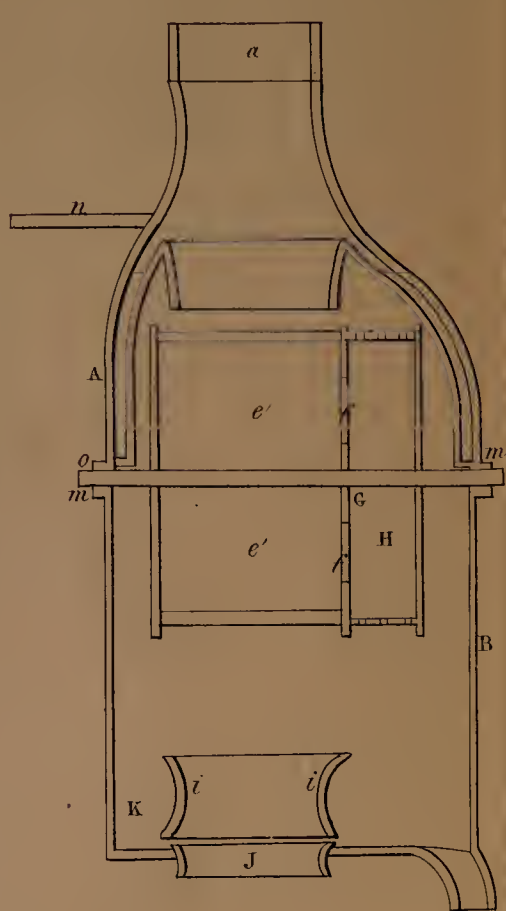


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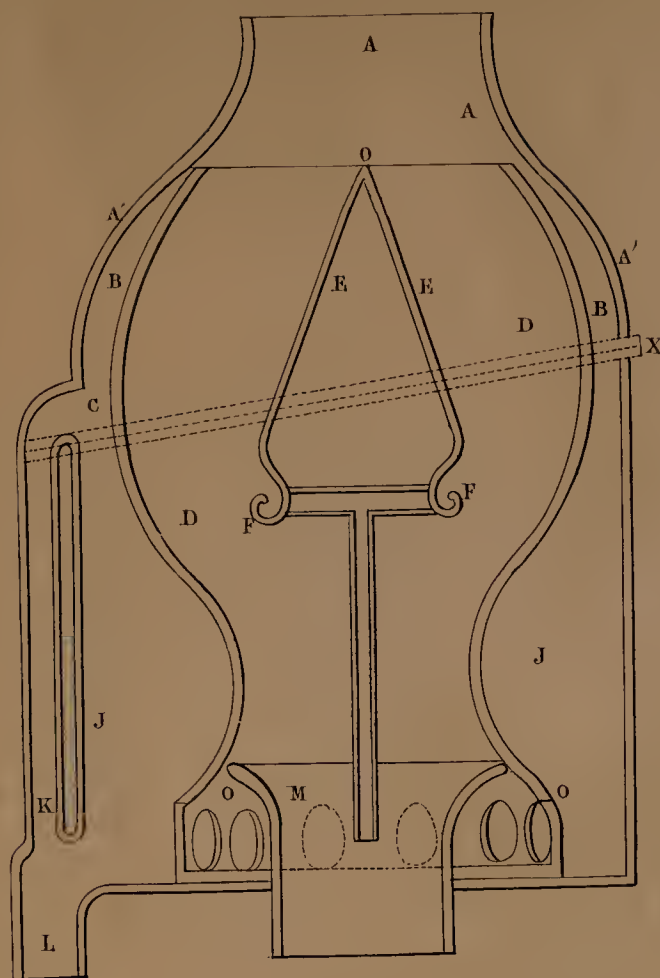


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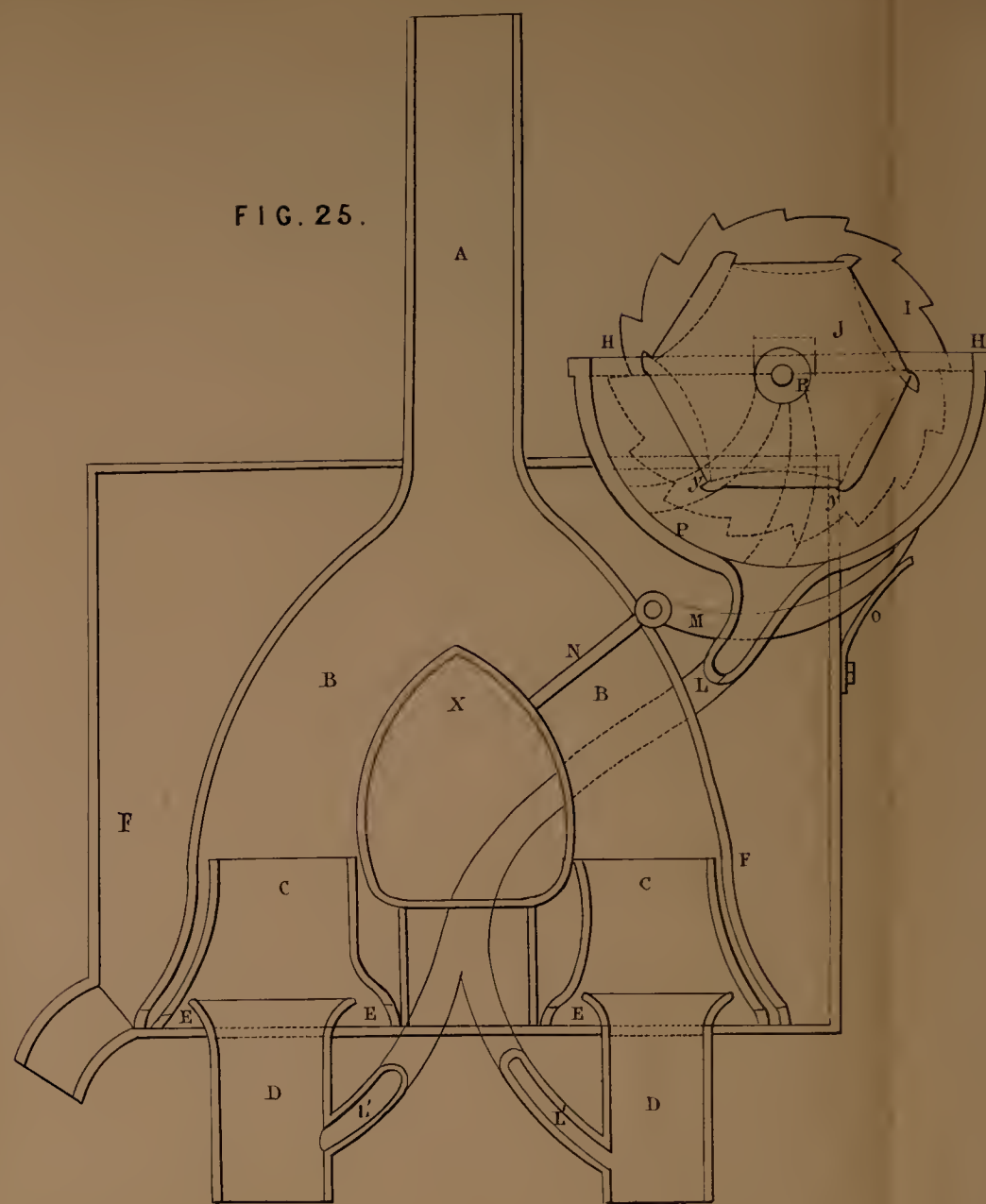


FIG. 27.

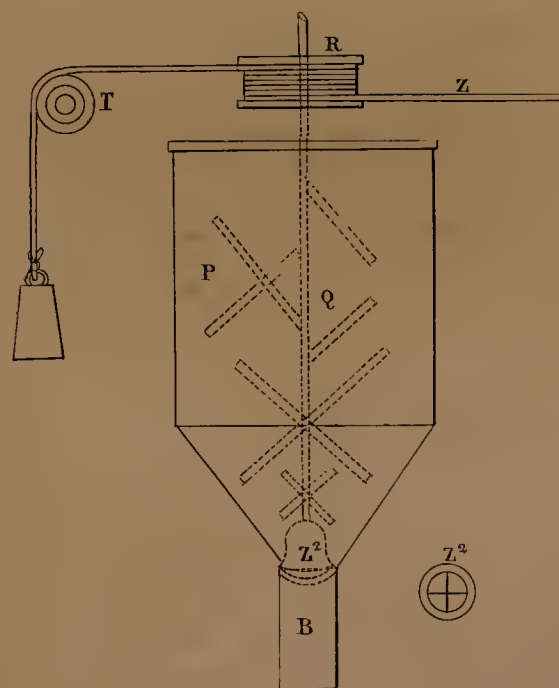


FIG. 26.

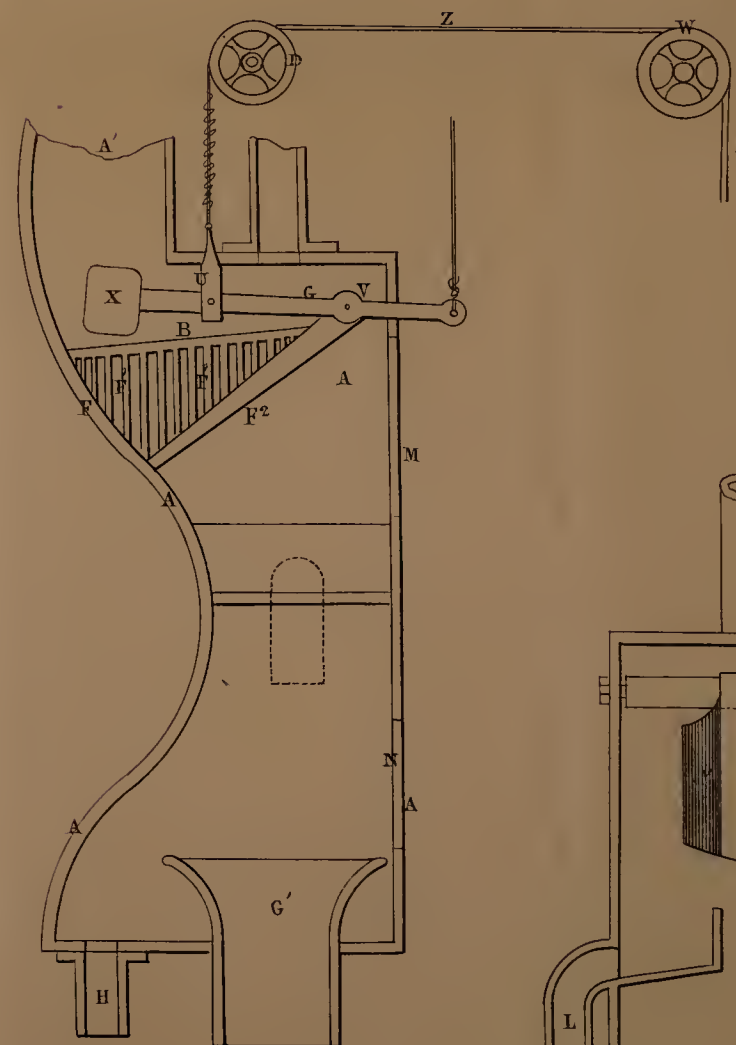


FIG. 28.

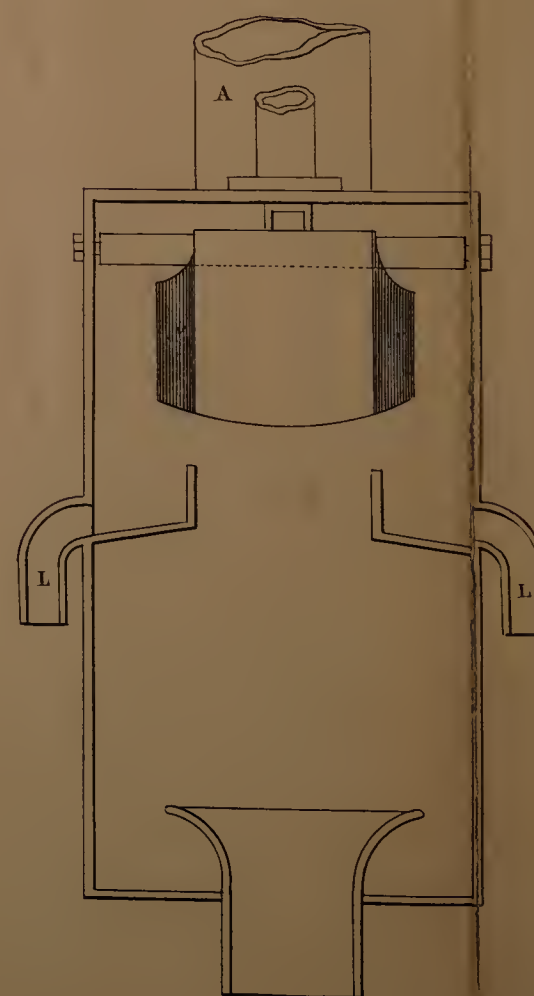


FIG. 20.

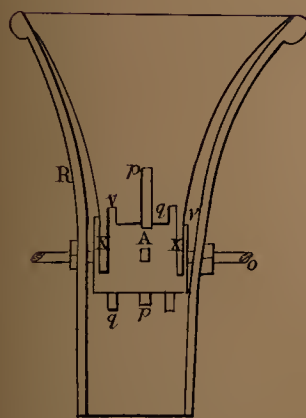


FIG. 21.

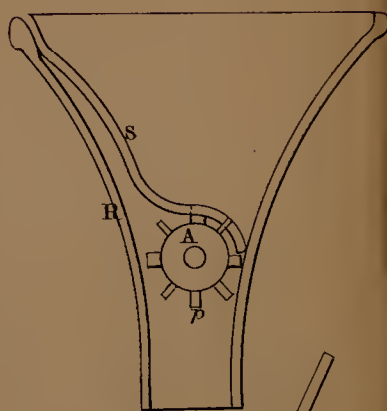


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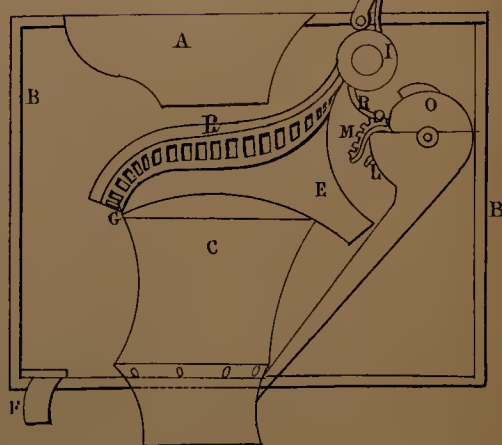
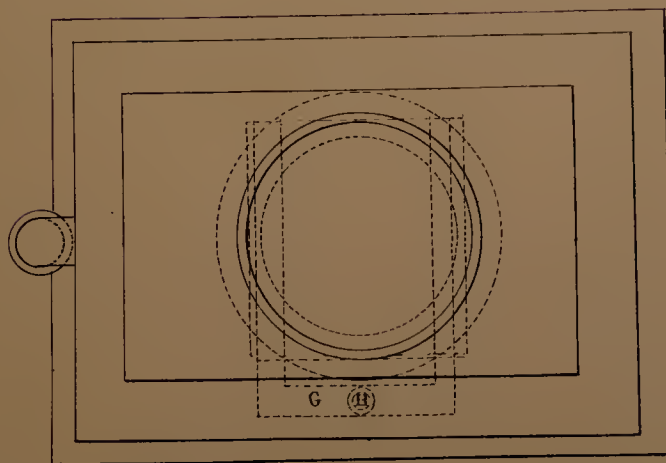


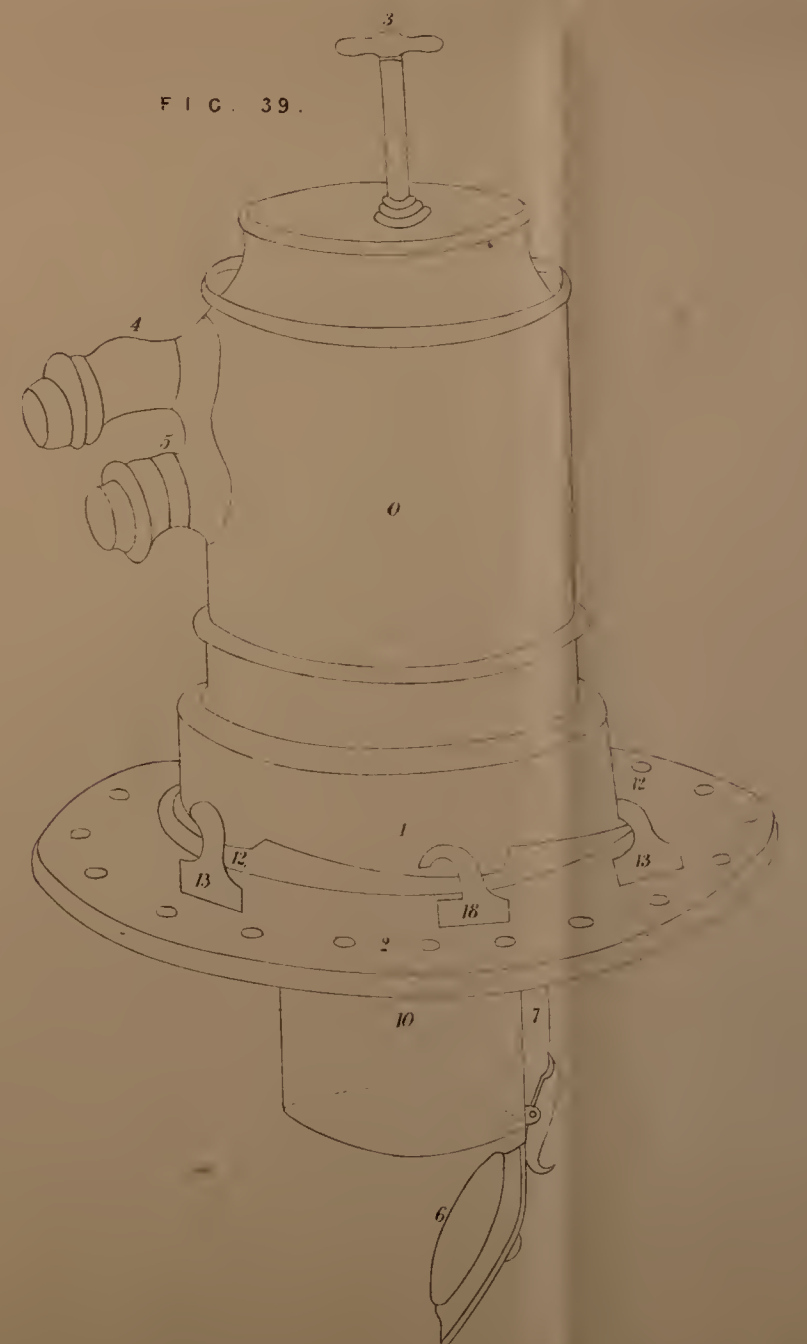
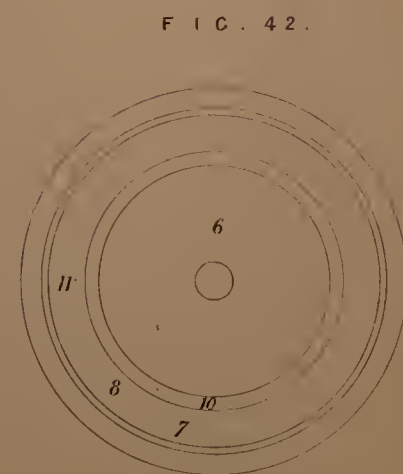
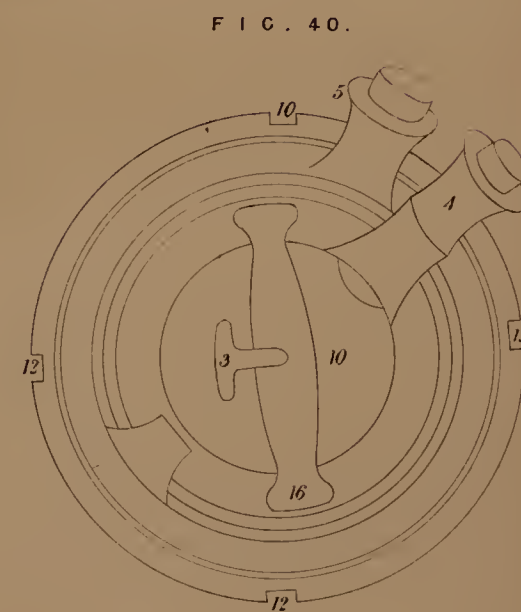
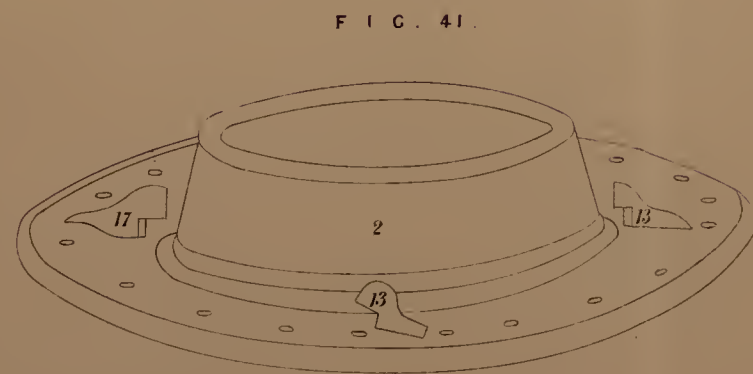
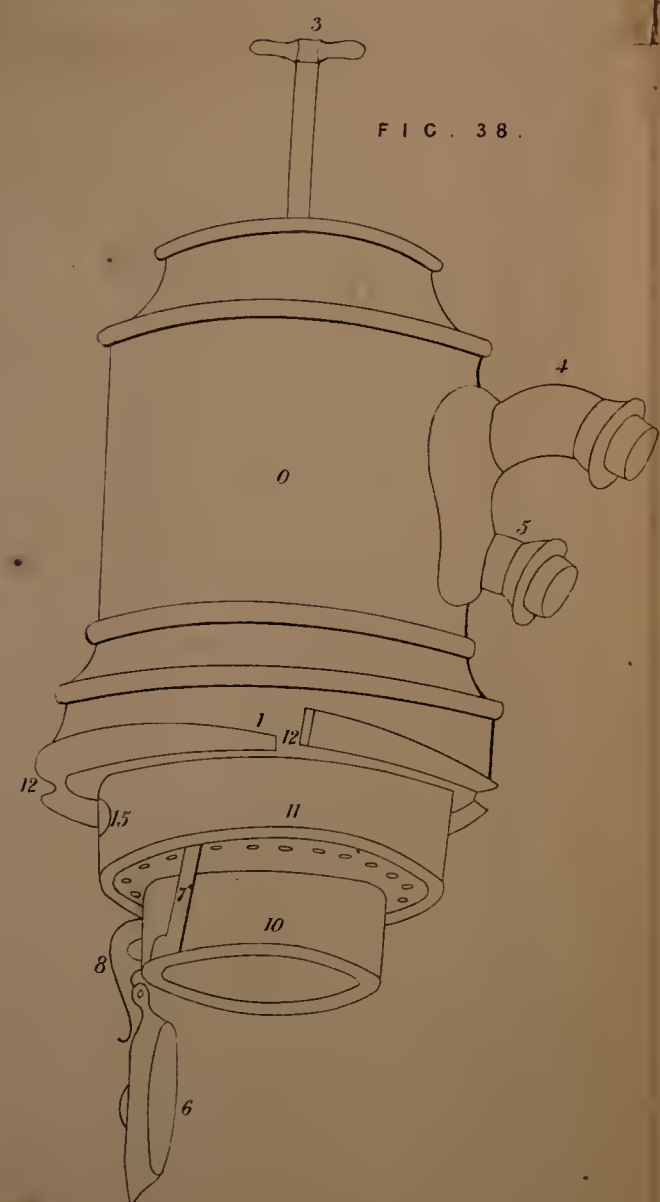
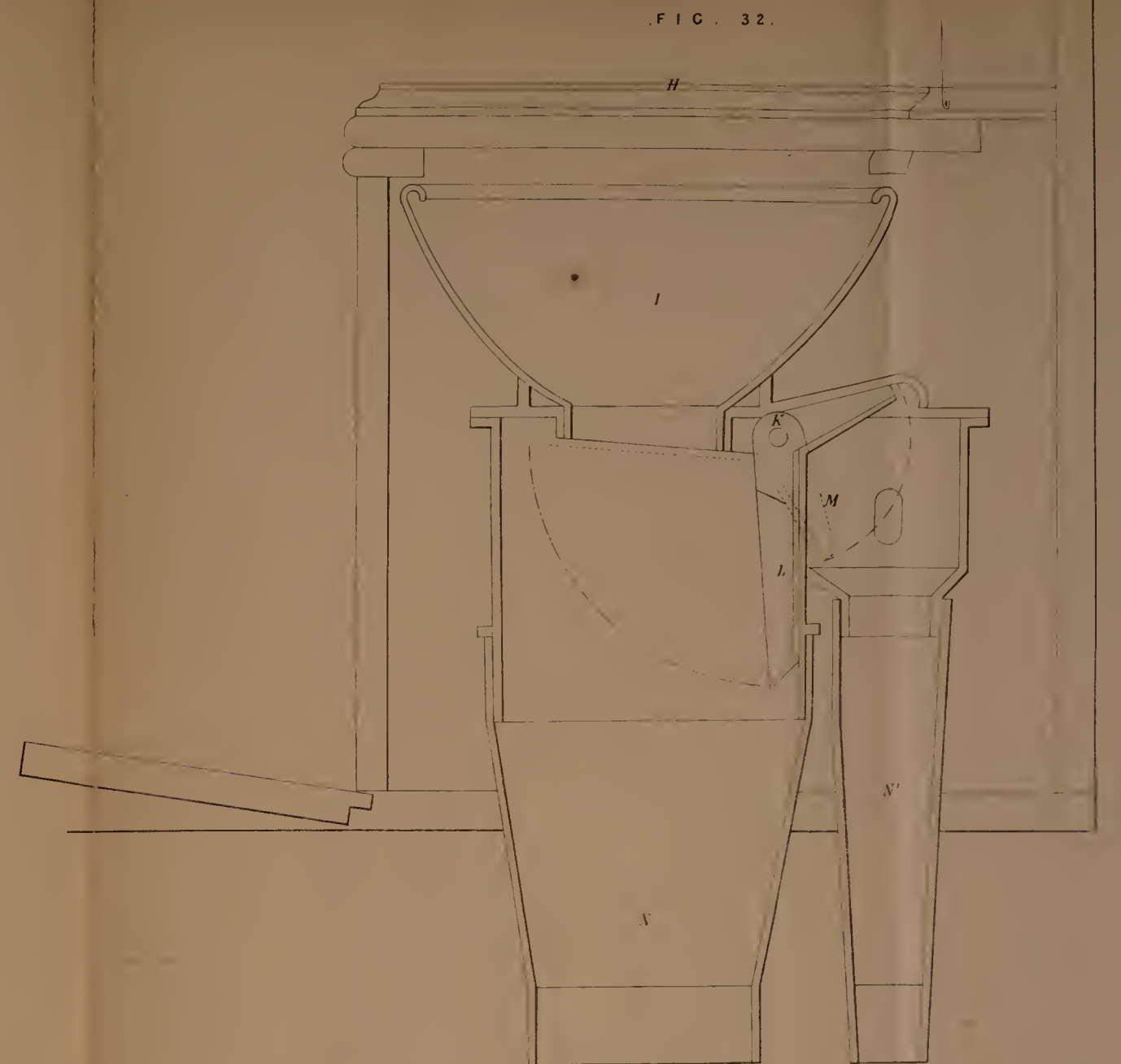
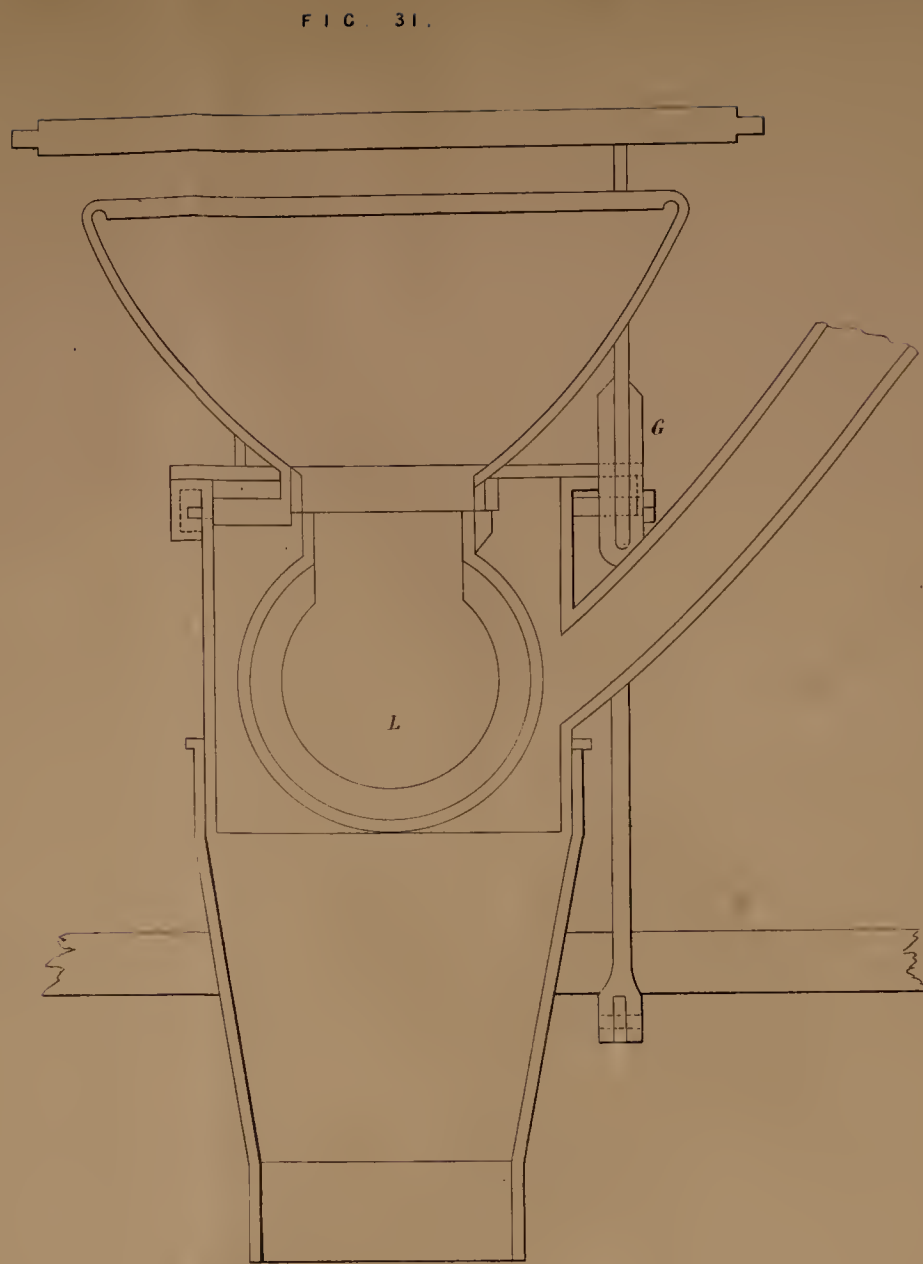
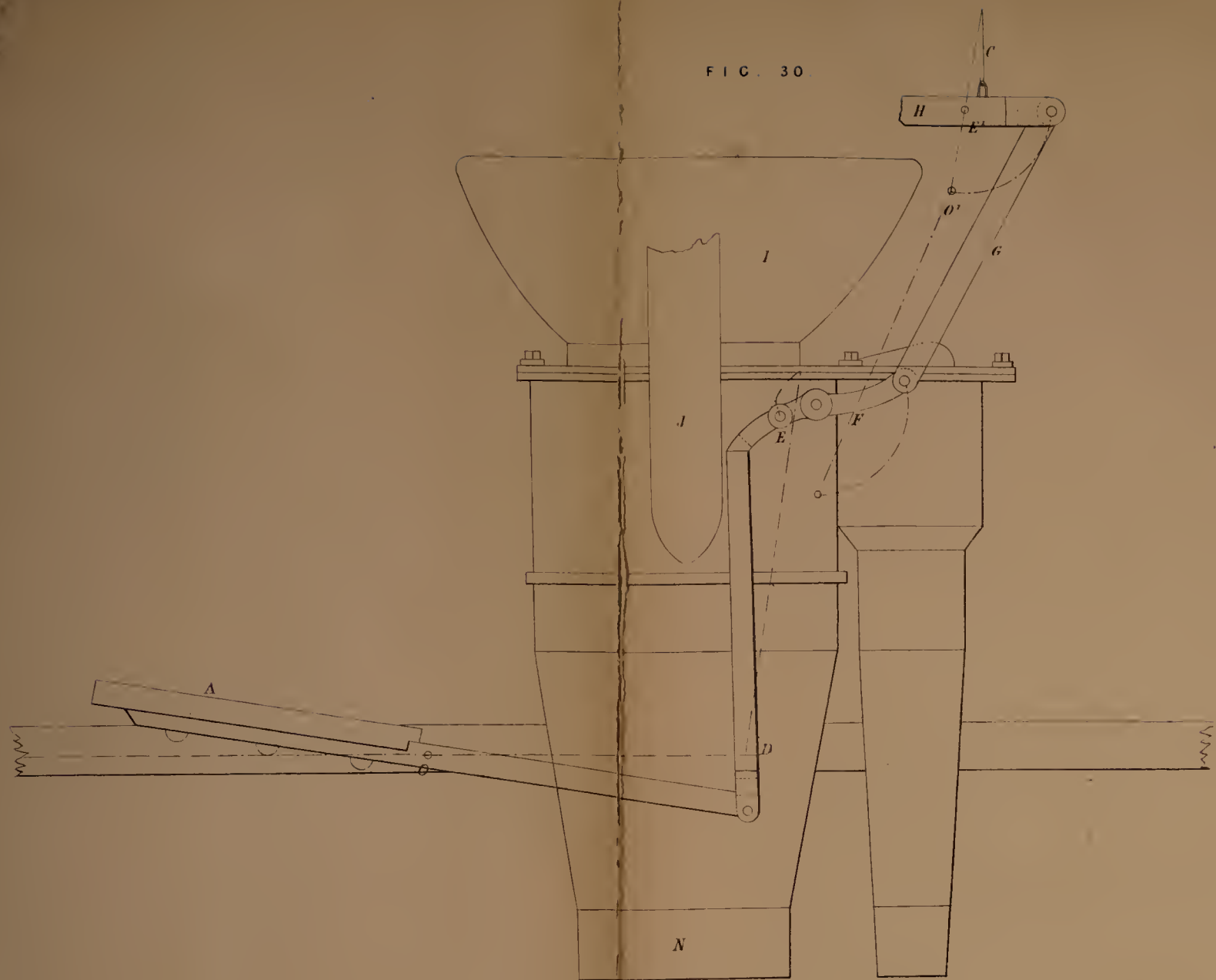
FIG. 24.













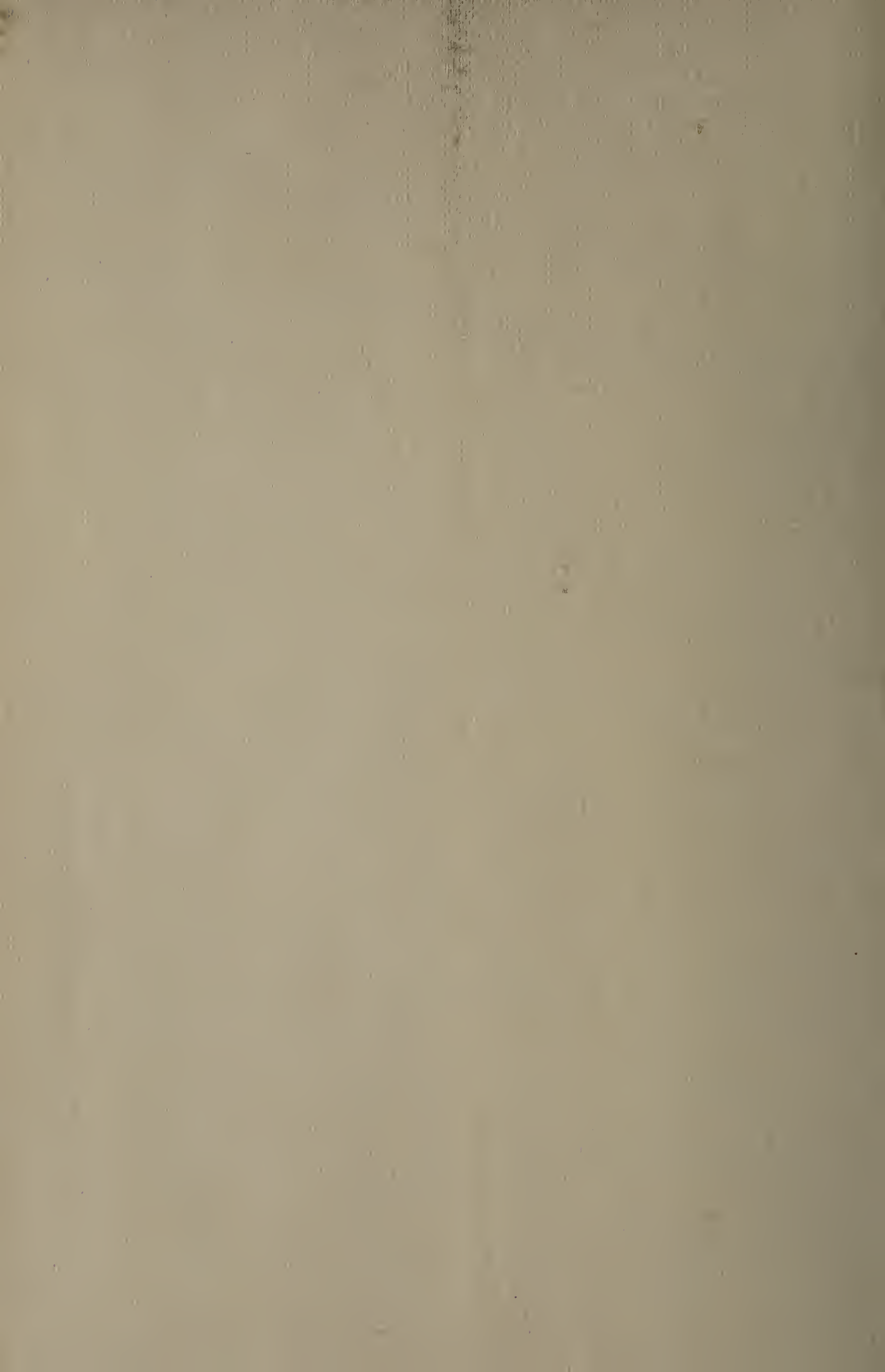




FIG. 33.

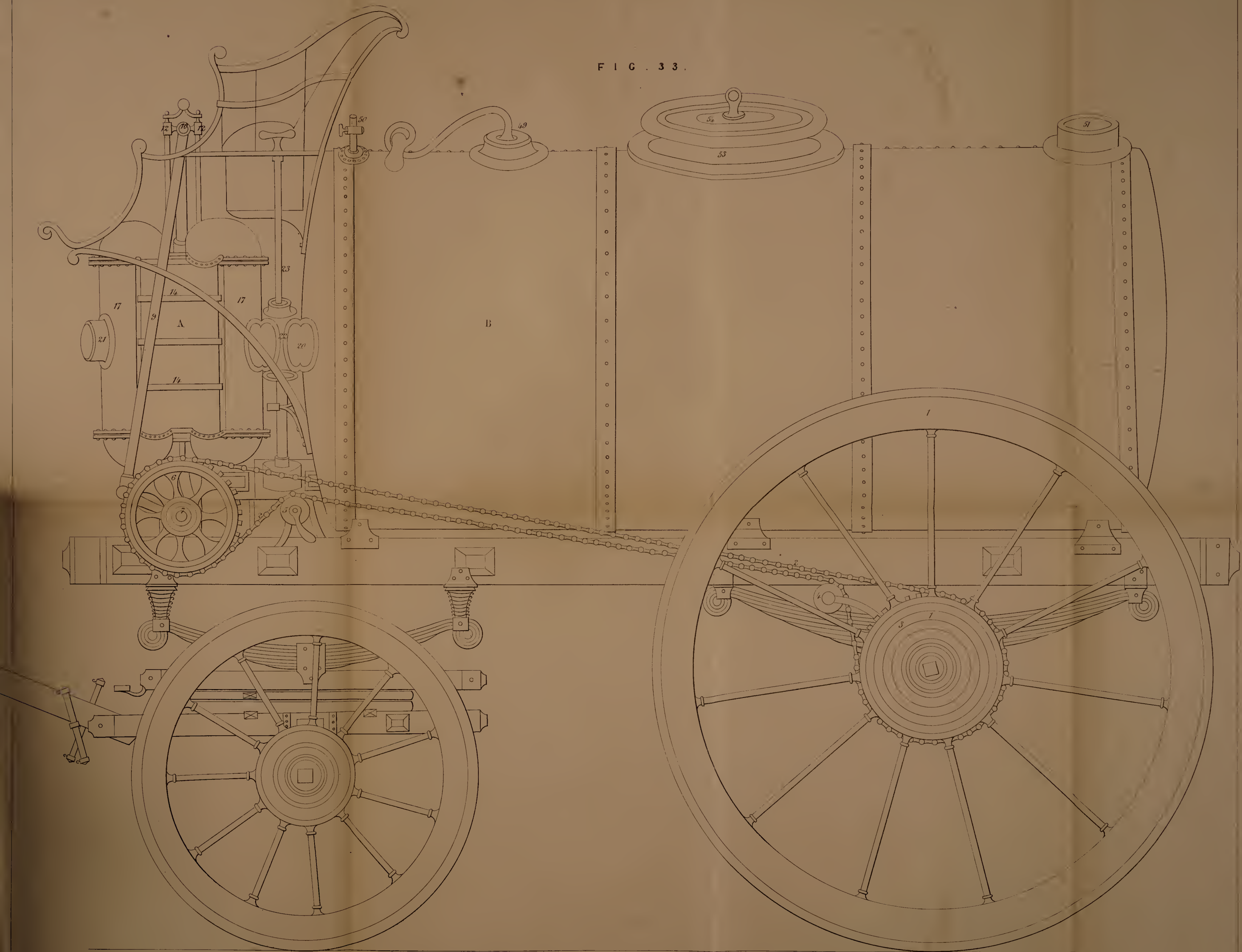








FIG. 34.

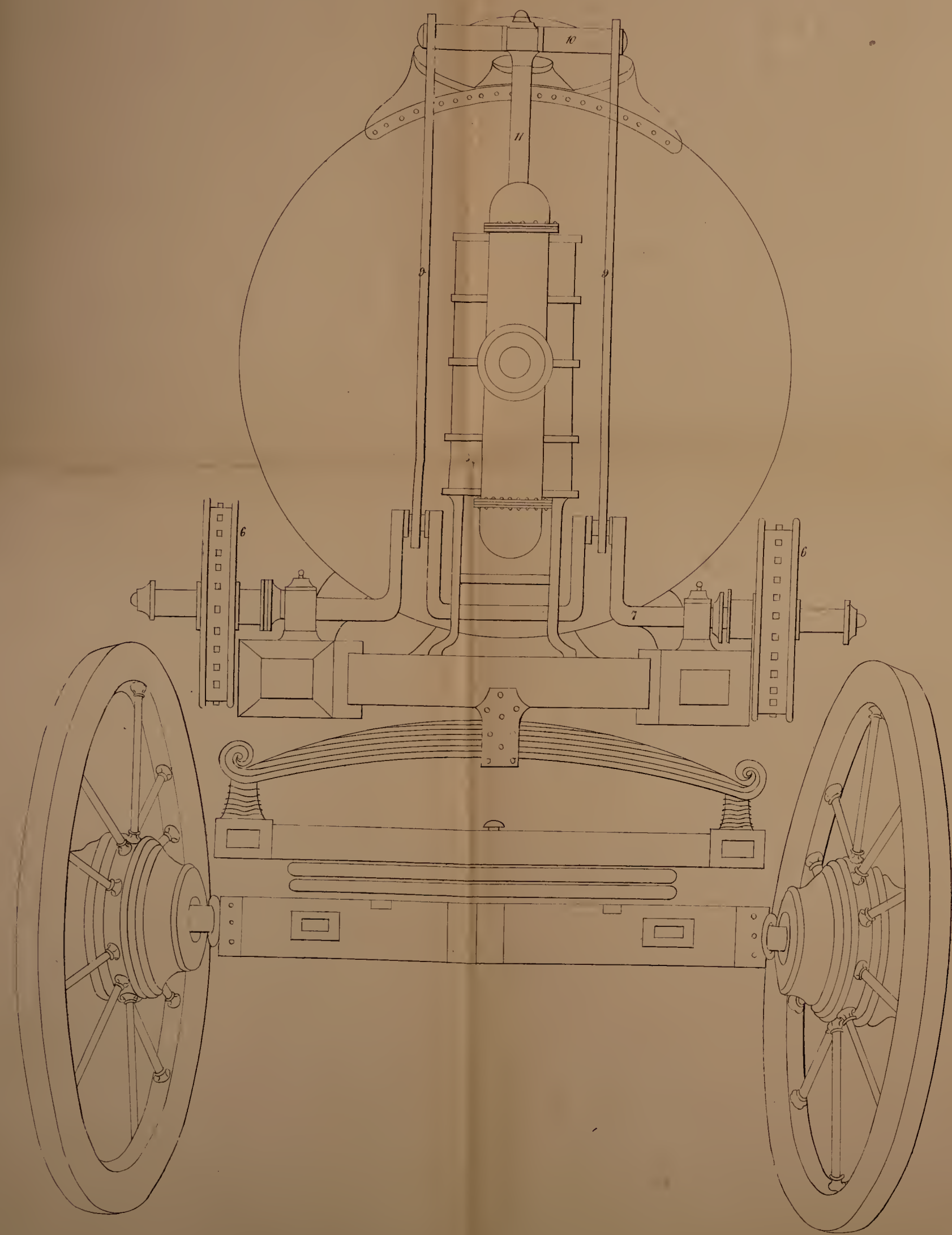


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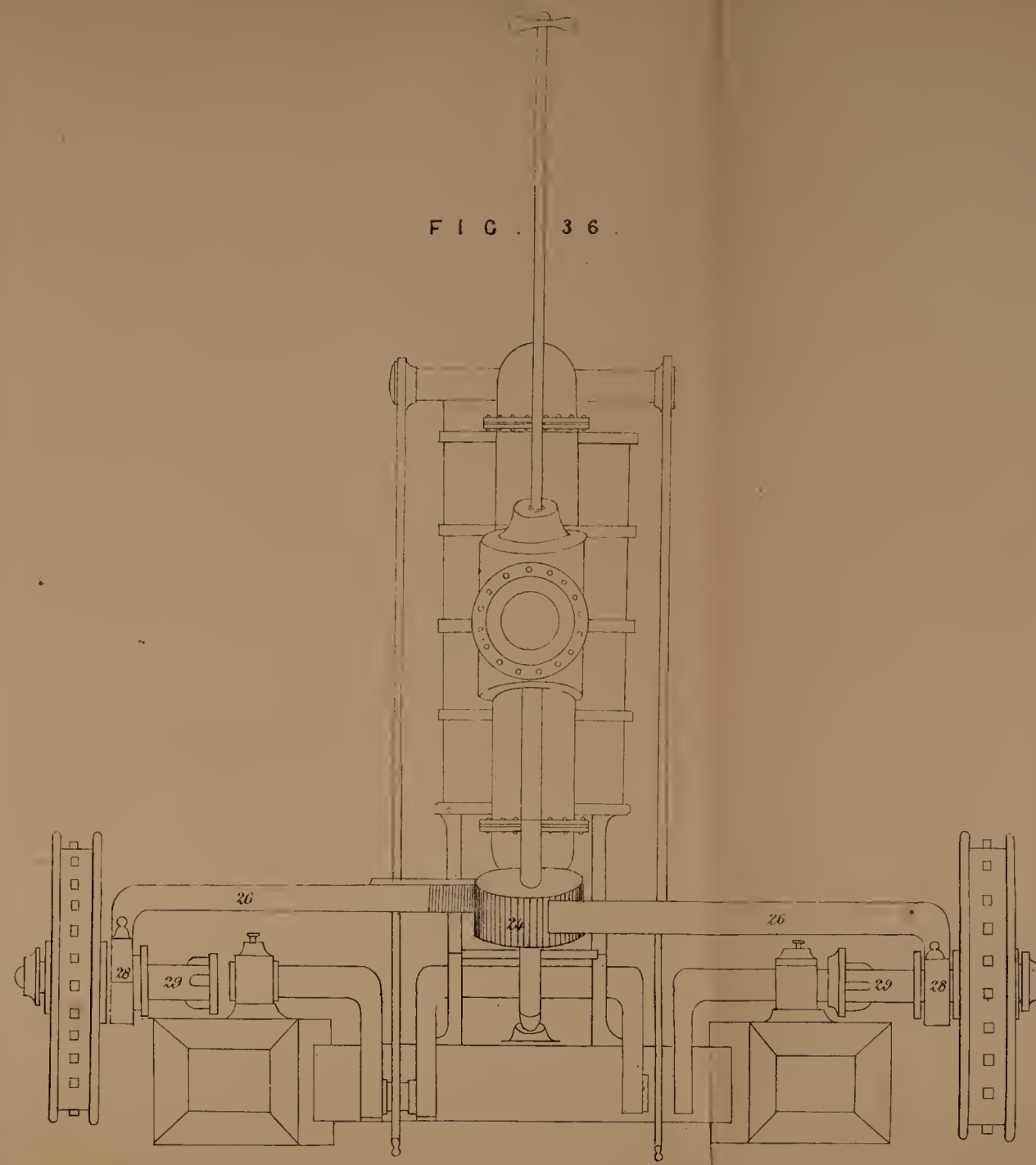


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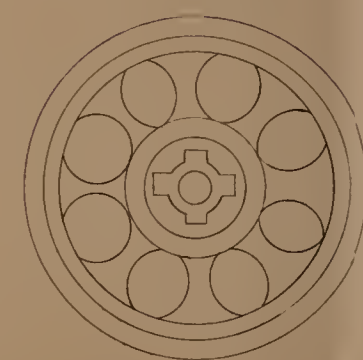


FIG. 35.

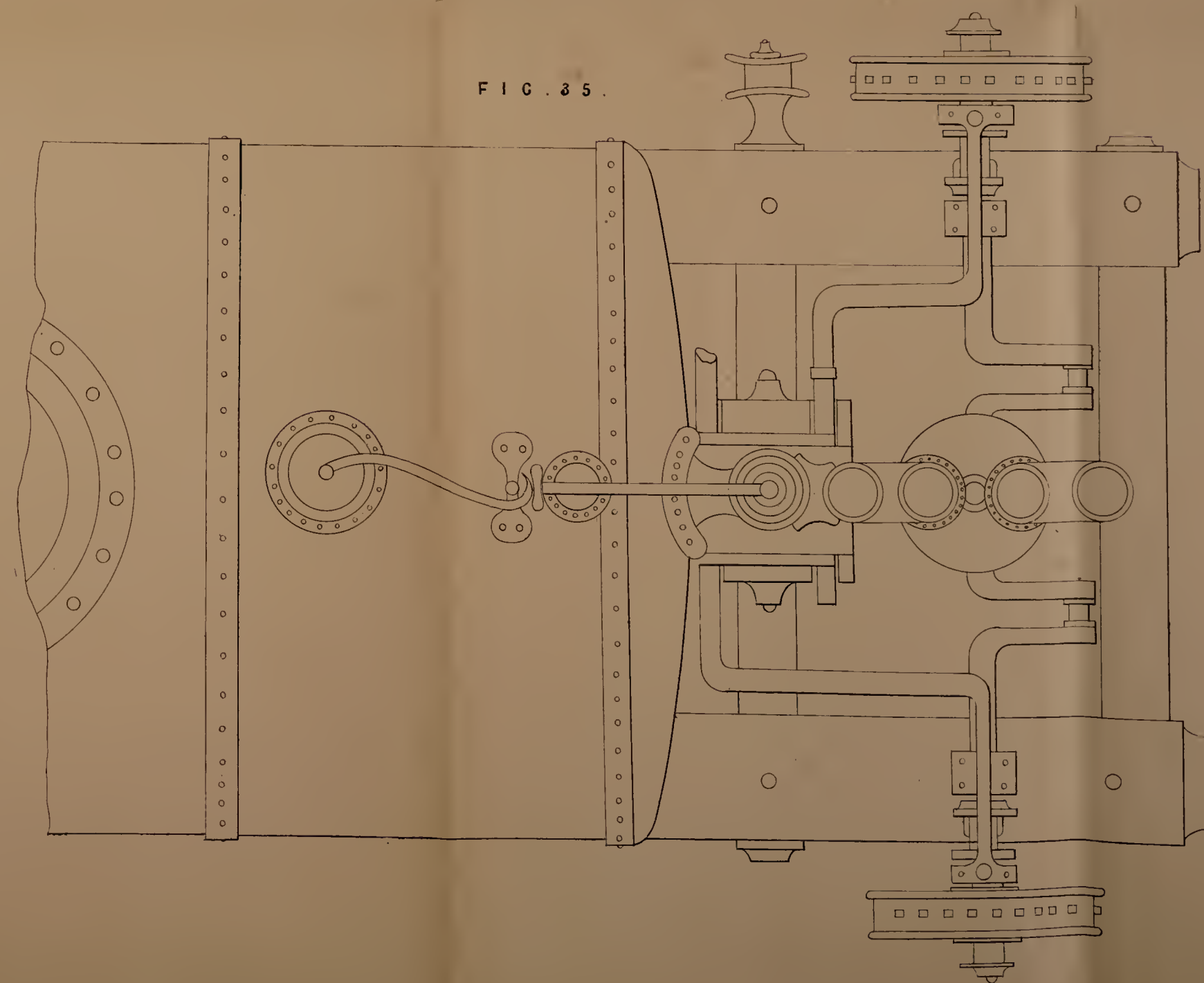








FIG. 43.

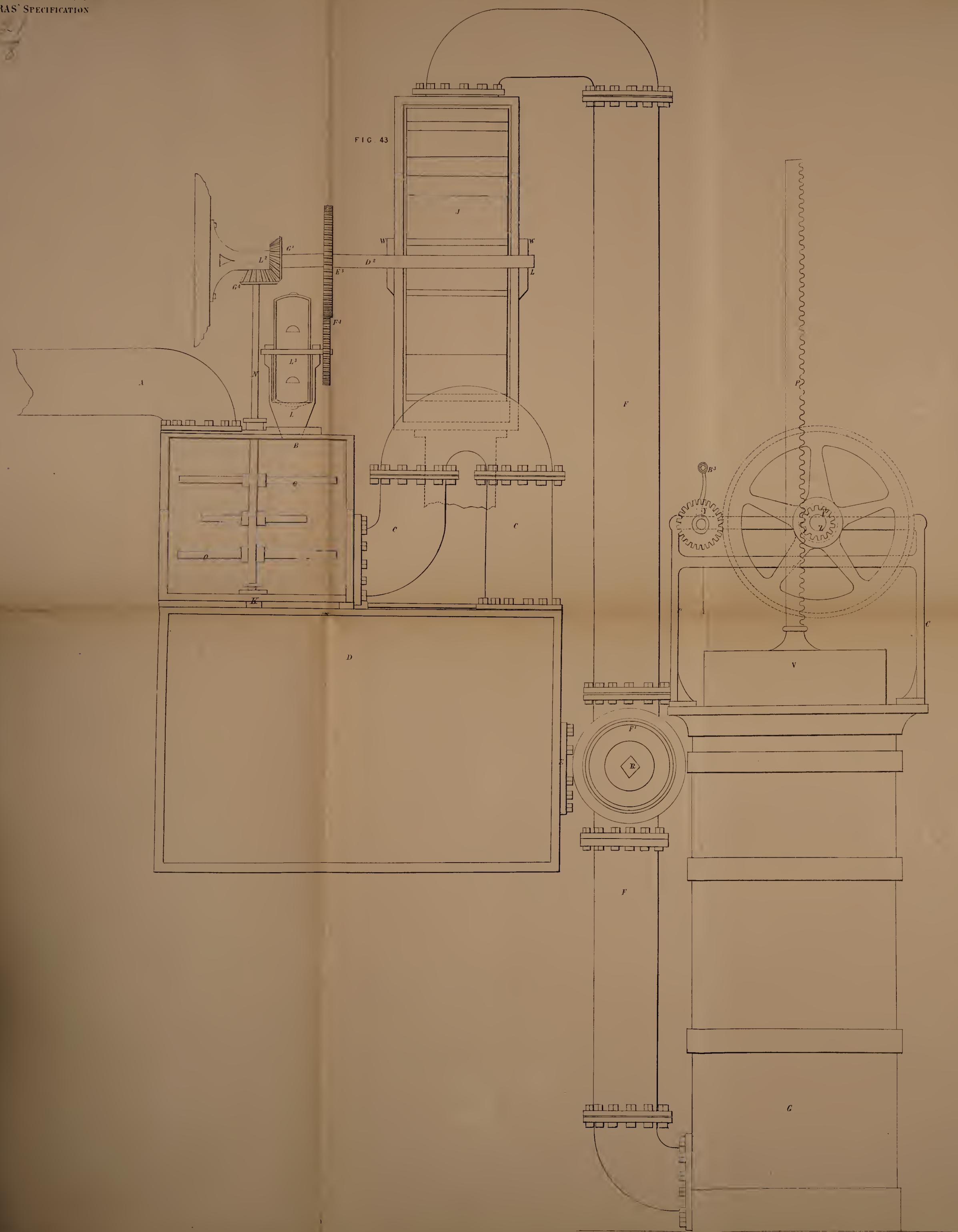


FIG. 44.

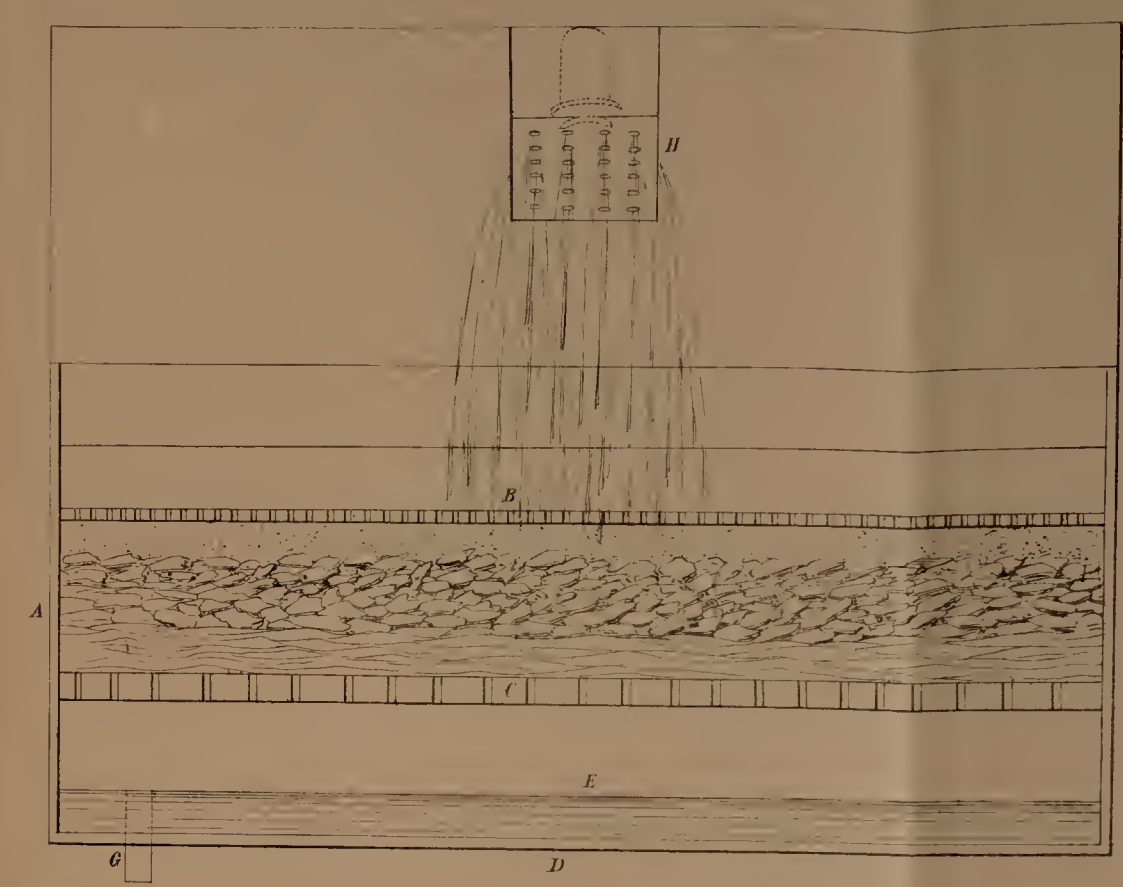


FIG. 45.

